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THESIS

MATERIEL MANAGEMENT IN THE UNITED STATES MARINE CORPS WAR RESERVE SYSTEM

by

Donald Phillip Shirk

September 1980

Thesis Advisor: Dan C. Boger

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20. (continued)

how physical assets are managed, and what alternatives to materiel stockage exist. Concentrating on item selection, requirements determination, replacement factors and budgeting, Marine Corps procedures are discussed in detail and analyzed along with those of other services. Recommendations are made for greater automation, a new method for quantifying item essentiality, construction of skeleton tables of equipment, additional uses of war reserves, and alternatives to war reserve stocks.

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Materiel Management in the United States Marine Corps War Reserve System

by

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Captain, United States Marine Corps
B.S., United States Naval Academy, 1973

Submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
September 1980

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War Reserves are designed to provide committed/activated forces with critical support during the initial stages of conflict and until the DOD materiel distribution system and its industrial base are fully mobilized. Maintaining these assets in a ready and readily available status while trying to derive some utility from the inventory is a dilemma. This thesis approaches the problem by exploring how war reserve budget dollars are allocated, how physical assets are managed, and what alternatives to materiel stockage exist. Concentrating on item selection, requirements determination, replacement factors and budgeting, Marine Corps procedures are discussed in detail and analyzed along with those of other services. Recommendations are made for greater automation, a new method for quantifying item essentiality, construction of skeleton tables of equipment, additional uses of war reserves, and alternatives to war reserve stocks.

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LIST OF ABBREVIATIONS

APO	Acquisition Project Officer
AR	Automatic Resupply
CAAR	Combat Active Attrition Rate
CARF	Combat Active Replacement Factor
CBO	Congressional Budget Office
CCAP	Commercial Commodity Acquisition Program
CEM	Concepts Evaluation Model
CG	Consolidated Guidance
CMC	Commandant of the Marine Corps
CSS RQ	Combat Support Stock Requirement
DC/S I&L	Deputy Chief of Staff for Installations and Logistics
DC/S P&O	Deputy Chief of Staff for Plans and Operations
DOD	Department of Defense
DWT	Division-Wing Team
FEBA	Forward Edge of the Battle Area
FMF	Fleet Marine Force
FSSG	Force Service Support Group
HQMC	Headquarters Marine Corps
I&L	Installations and Logistics
ICP	Inventory Control Point
IDF	Item Data File
IMM	Integrated Materiel Manager
IPP	Industrial Preparedness Planning

JCS	Joint Chiefs of Staff
JSPS	Joint Strategic Planning System
LCAC	Air-Cushioned Assault Landing Craft
LFORM	Landing Force Operational Reserve Materiel
LMI	Logistics Management Institute
LMIS	Logistics Management Information System
LSD	Dock Landing Ship
LSG	Logistics Support Group
LSU	Logistics Support Unit
LVT	Tracked Landing Vehicle
MAB	Marine Amphibious Brigade
MAF	Marine Amphibious Force
MAGCC	Marine Air Ground Combat Center
MAGTF	Marine Air Ground Task Force
MAU	Marine Amphibious Unit
MAW	Marine Air Wing
MCLB	Marine Corps Logistics Base
MILCON	Military Construction
MO	Mount Out
MOA	Mount Out Augmentation
MPS	Maritime Prepositioning Ship
NTPS	Near Term Prepositioned Ship Program
O&MMC	Operations & Maintenance Marine Corps Appropriation
OMB	Office of Management and Budget
OWRMR	Other War Reserve Materiel Requirement

PFMR	Peacetime Force Materiel Requirement
PMC	Procurement Marine Corps
POL	Petroleum, Oil and Lubricants
POM	Program Objective Memorandum
PPBS	Planning, Programming, and Budgeting System
PPG	Planning and Programming Guidance
PWRMR	Prepositioned War Reserve Materiel Requirement
PWRS	Prepositioned War Reserve Stock
RDF	Rapid Deployment Force
RORO	Roll-on/Roll-off vessel
SACEUR	Supreme Allied Commander, Europe
SRI	Stanford Research Institute
TAM	Table of Authorized Materiel
T/E	Table of Equipment
T/O	Table of Organization
WARF	Wartime Replacement Factor
WMPC	War Materiel Procurement Capability
WMR	War Materiel Requirement
WRM	War Reserve Materiel
WRMR	War Reserve Materiel Requirement

I. INTRODUCTION

A. THESIS INTENT

The original proposal for this study was made by war reserve managers at the Marine Corps Logistics Base in Albany, Georgia. Their concern was with ways to better utilize the war reserve assets of the Marine Corps. At that point a study of war reserve procedures was begun, intentionally avoiding extreme reliance on any single source or on current practitioners in the field as a group. The intent was to perform a management analysis of the process, letting sound principles of organization and common sense dictate the course of that analysis and the nature of feasible alternatives to be examined.

The question of how to better use war reserve resources was formulated in three distinct components:

(1) how to make better use of war reserve dollars received in annual appropriations,

(2) how to make better use of the physical war reserve assets attained with appropriation dollars,

(3) what alternatives to war reserves exist for accomplishing the same purposes.

The intent of this thesis is to gain and present an understanding of the current system, examine problems, and offer recommendations relative to the questions listed above.

B. METHODOLOGY

The basic source of information for analysis was a literature search described later in this chapter. After documenting the flow of responsibility and information relative to war reserve management, an attempt was made to identify bottlenecks and formulate a type of critical decision path leading to asset attainment.

The key areas of item selection, requirements determination, replacement factors and budgeting were isolated for further examination. While other studies have looked at withdrawal, transport, and other aspects of physical handling and management, the thrust of this effort was to recommend changes to improve the efficiency with which the war reserve block is identified and built.

Although Albany was mainly concerned with major end items in supply class VII, all classes were surveyed, as were the war reserve procedures of other services. New ideas are explained in enough detail to provide a fundamental understanding and an appreciation of their potential to contribute to the Marine Corps war reserve program.

The basic intent and constraints in this study were such that the ultimate goal was arrows pointing to areas for further study rather than final answers. A heavy reliance on figures and flowcharts will be quickly perceived. Extracted in some instances from the tables and text of other sources,

or of original design, these figures are included to illustrate key points or clarify critical processes and flows. The lack of such figures in Marine Corps orders and directives is seen as a hindrance to understanding the full spectrum of actions and interactions. In this regard, the clear, concise description of current procedures was a goal in itself.

C. ORDER OF PRESENTATION

Following this introduction, Chapter II will present an overview of the current war reserve system which provides a basis for detailed study of specific sectors.

Chapters III through VI examine key areas by describing current procedures, highlighting problems, comparing methods in use in other services, and discussing significant in-house or contractor studies and recommendations.

Chapter VII addresses a variety of problems and alternatives, including future implications of current decisions to be made regarding new roles and missions for the Corps. The final section of the study presents a brief summary and specific conclusions and recommendations.

D. SOURCES OF INFORMATION

The major sources of information used in this study include:

(1) Marine Corps orders and directives,

(2) studies by consultants,

(3) U.S. Army procedures and studies by the Concepts Analysis Agency,

(4) telephone conversations with various offices at Headquarters Marine Corps and Albany, Georgia,

(5) General Accounting Office reports,

(6) earlier theses and articles.

As some of the sources, notably the consultant studies, contained extensive literature surveys of their own, and as the search capabilities of several DOD repositories were used to screen possible sources, this study has considered a significant portion of the work in the field.

The only significant problems encountered in this study were related to information, and included (1) the classified nature of many relevant sources, and (2) the wealth of new developments, ideas and articles which have appeared in recent months. The solution in the first instance was to largely ignore classified information with the exception of a small number of key studies which were reviewed. The section in Chapter VII dealing with the future tries to capture the impetus for and implications of recent activity in the war reserve area.

E. MISSION AND ORGANIZATION OF THE MARINE CORPS

The introduction will conclude with an overview of the missions, roles, and structure of the Marine Corps.

The mission of the Marine Corps is defined by statute as follows: [1:651]

> The Marine Corps, within the Department of the Navy, shall be so organized to include not less than three combat divisions and three air wings, and such other land combat, aviation, and other services as may be organic therein. The Marine Corps shall be organized, trained, and equipped to provide fleet marine forces of combined arms, together with supporting air components, for service with the fleet in seizure or defense of advanced naval bases and for the conduct of such land operations as may be essential to the prosecution of a naval campaign. In addition, the Marine Corps shall provide detachments and organizations for service on armed vessels of the Navy, shall provide security detachments for the protection of naval property at naval stations and bases, and shall perform such duties as the President may direct. However, these additional duties may not detract from or interfere with the operations for which the Marine Corps is primarily organized.
>
> The Marine Corps shall develop, in coordination with the Army and the Air Force, those phases of amphibious operations that pertain to the tactics, technique, and equipment used by landing forces.
>
> The Marine Corps is responsible, in accordance with joint mobilization plans, for the expansion of peacetime components of the Marine Corps to meet the needs of war.

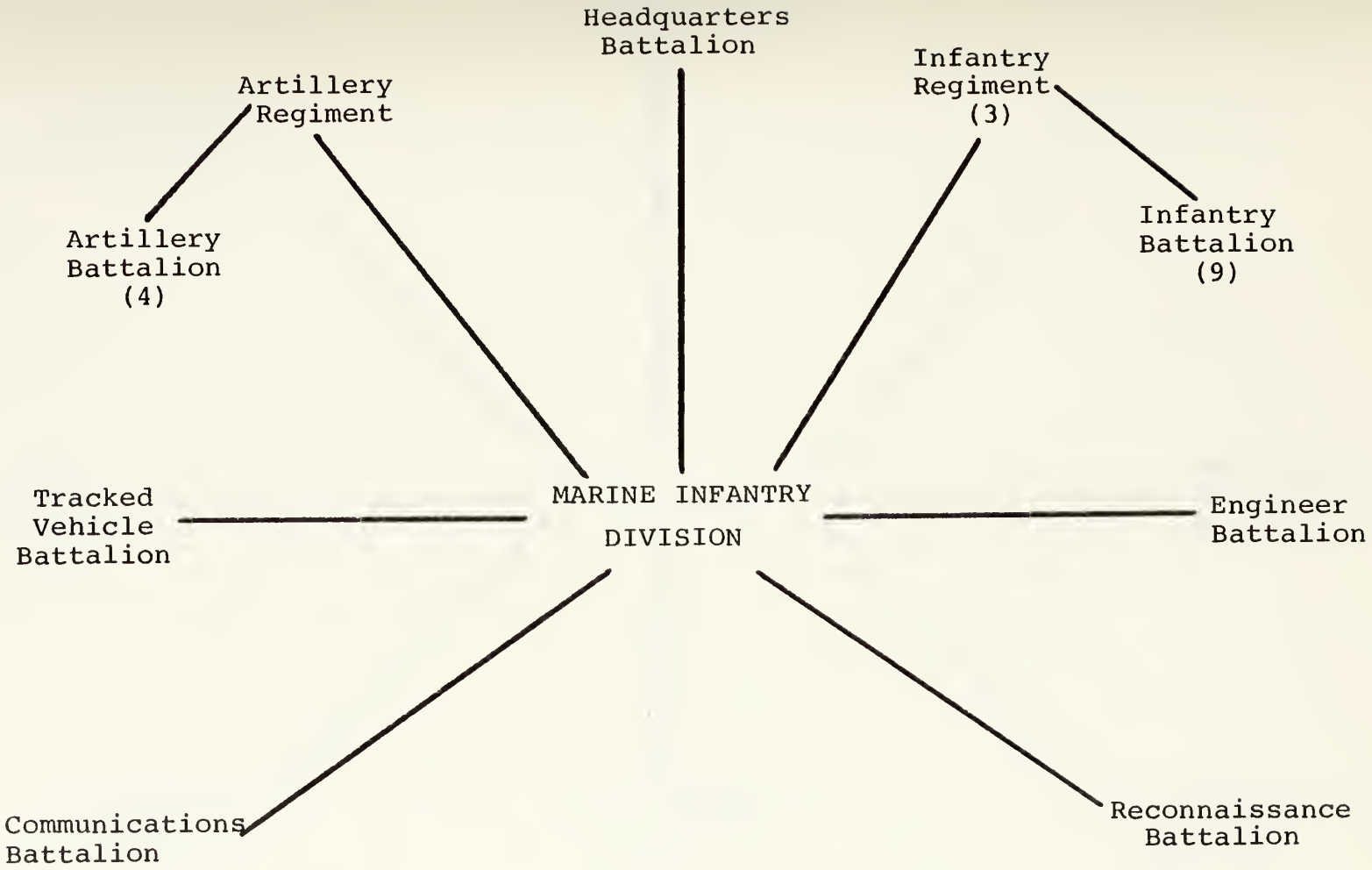
A recent study by the Congressional Budget Office (CBO) describes the Marine Corps as, "The United States' primary long-distance, general-purpose force." [2:xi] Recent developments in Afghanistan and Iran, the formation of a joint Rapid Deployment Force (RDF), maritime prepositioning of equipment

and supplies, and continuing questions of NATO vulnerability prompted CBO to examine the viability of traditional missions and the likely nature of future roles for the Corps. Change in any form or continuance of the traditional missions in today's world carries significant implications for war reserve needs and management.

The Commandant of the Marine Corps addressed these developments by stating: [3:1]

> The recent invasion of Afghanistan and the potential for further Soviet expansion in that part of the world have prompted a thorough review of our nation's ability to respond to challenges which threaten vital U.S. interests overseas. Many new programs which will significantly enhance our capabilities to respond effectively to deter aggression in remote regions of the world are currently under development--more are being considered.
>
> Since the Persian Gulf crisis erupted, there has been an increased interest and growing recognition of Marine Corps capabilities. Because of our readiness and ability to deploy quickly to the scene of a crisis, we can expect to assume an even greater role in the defense of our nation in the years ahead. The major role given to Marine forces assigned to the Rapid Deployment Joint Task Force (RDJTF) already affirms this.
>
> The next few years will be a period of great challenge for the Corps ...

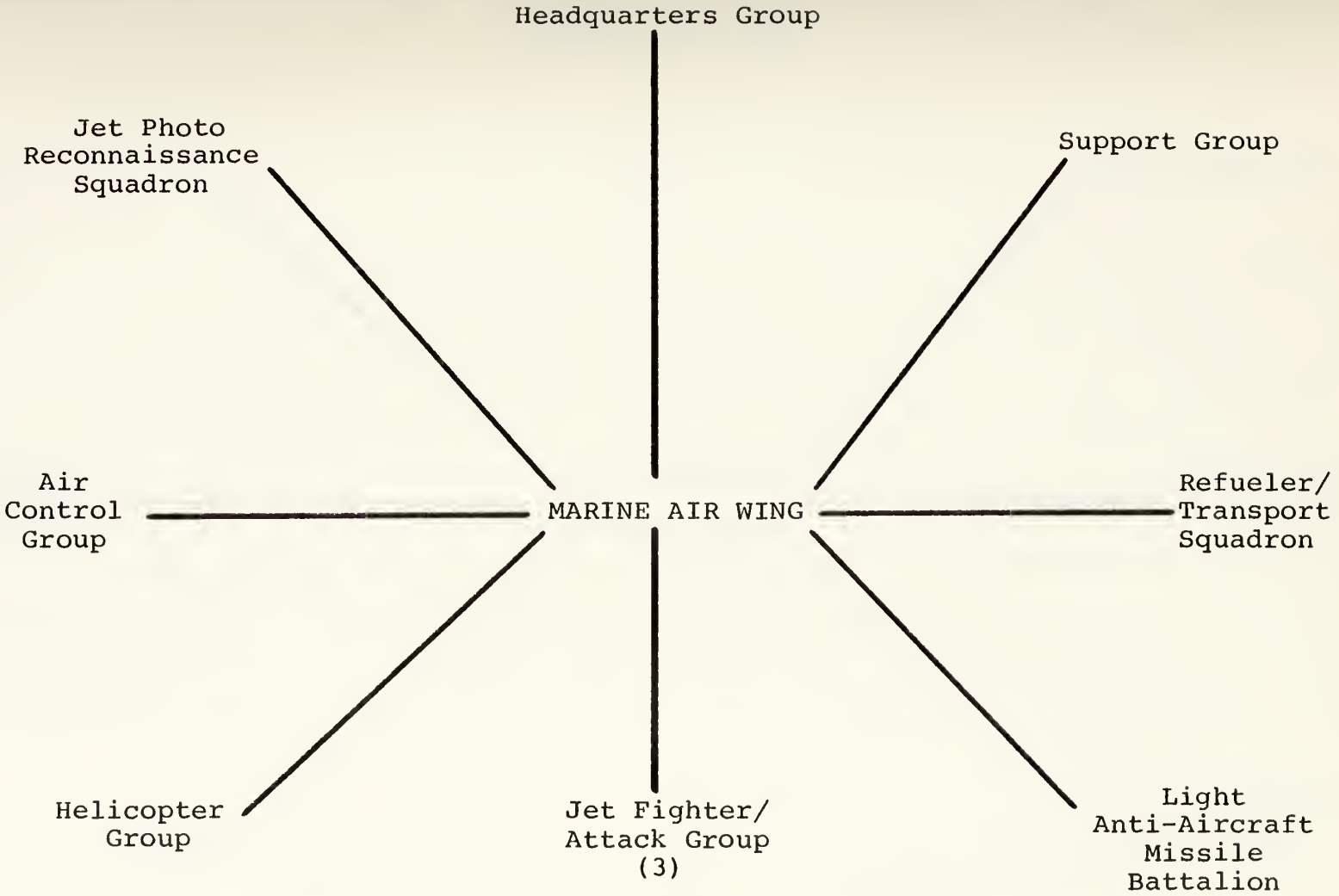
To perform its mission the Corps is organized into 185,200 active and 33,600 reserve personnel in three active divisions with associated air wings, and one reserve division-wing team (DWT). Each DWT has an associated Force Service Support Group (FSSG) as well, to provide logistics augmentation and support. Figures 1-1 through 1-3 illustrate the typical components of a Division, Wing, and FSSG.



NOTE: ( ) indicates number of units per Division if more than 1.

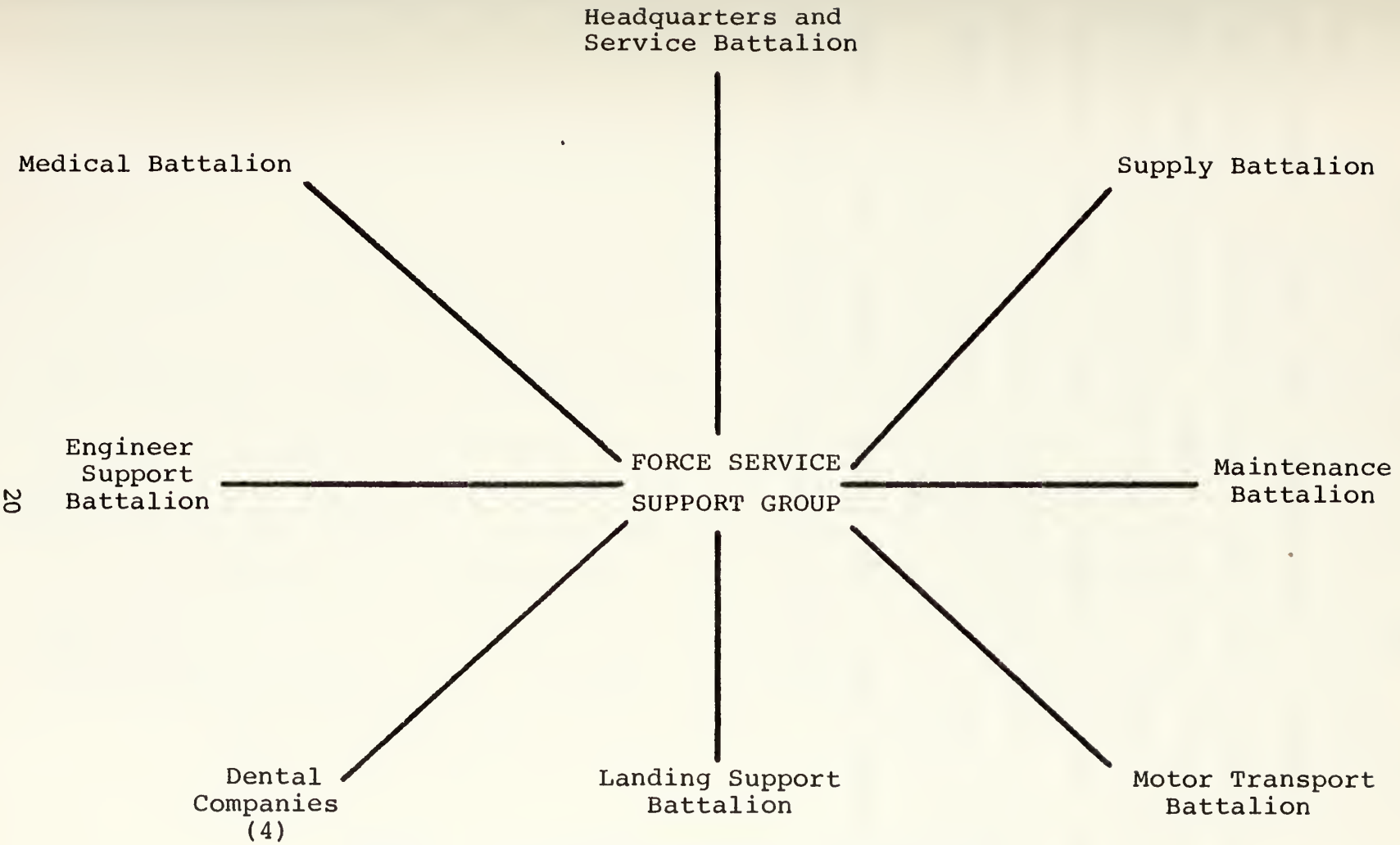
ORGANIZATION OF A MARINE INFANTRY DIVISION

Figure 1-1



NOTE: (_) indicates number of units per Wing if more than 1.

ORGANIZATION OF A MARINE AIR WING
Figure 1-2



NOTE: (_) indicates number of units per FSSG if more than 1.

ORGANIZATION OF A MARINE FORCE SERVICE SUPPORT GROUP

Figure 1-3

The Corps' formal structure links Division, Wing and FSSG units into Marine Amphibious Forces (MAF). Operationally, Marine Corps doctrine takes an ad-hoc approach to meeting requirements through task organization. Elements of a DWT and FSSG are combined to form a task force commensurate with the immediate mission. Figure 1-4 shows the major levels of combined Marine Air Ground Task Forces (MAGTF) and the typical missions assigned to each. The capability of not only task organizing, but tailoring and fine-tuning the task force components is a fundamental principle of Marine Corps readiness.

With a basic knowledge of the Corps' mission and structure, Chapter II will address DOD and service war reserve policy, and examine how the Marine Corps does the job.

MARINE AIR GROUND TASK FORCES

Task Force	# Troops	Infantry Unit	Wing Unit	FSSG Unit	Mission
Marine Amphibious Unit (MAU)	1,800 - 2,200	Battalion (1/9 division)	Helicopter Detachment (1/9 wing)	Logistics Support Unit (LSU)	Peacetime Presence
Marine Amphibious Brigade (MAB)	13,000 - 16,000	Regiment (1/3 division)	Multipurpose Air Group (1/3 wing)	Logistics Support Group (LSG)	Amphibious Assault and Landings
Marine Amphibious Force (MAF)	45,000	Division	Wing	FSSG	Major Amphibious Assault Operations

Figure 1-4

II. AN OVERVIEW OF THE WAR RESERVE SYSTEM

This chapter will survey the war reserve system by examining the who, what, where, and why underlying the concept.

A. PURPOSE AND DEFINITION

As a part of logistics readiness, the Department of Defense (DOD) is responsible for maintaining sufficient assets to meet surge demands for major military systems, supplies, equipment, and component parts. This responsibility stems from lessons learned during and after World War II which dramatically emphasize that modern warfare is increasingly less forgiving of the unprepared and will not tolerate a slow build-up of resources. Additionally, new uncertainties and contingencies place added premiums on flexibility and promptness of response.

The Marine Corps War Reserve Manual states: [4:1-3]

> There is a continuing requirement to improve the procedures for providing supply support for those items of equipment which are combat essential. Since Korea, the commitment of FMF's (Fleet Marine Forces) has been characterized by a pattern of successive and intermittent contingencies in which a state of war or national emergency has not been declared. These actions required the expanded use and deployment of the FMF's for varying and uncertain periods of time. Invariably, these actions require materiel support at a rate above normal peacetime levels. To date, these extra levels of effort have been supported by significant drawdowns of normal peacetime operating levels, emergency supplemental funding, and invading otherwise sacrosanct mobilization stocks.

> It is clearly evident that the policy of management of mobilization requirements ... requires modification to provide for a level of stocks to be available to meet emergency situations which will occur without a formal declaration (of war) as well as those that may be established by a presidential proclamation of national emergency.

Timely support is certainly not a new challenge for military logistics. The purpose of a supply system has traditionally been expressed as having the right item in the right place at the right time, and in the proper amount. An equally well-worn phrase is the procuring and providing of beans, bullets, and bandages.

Today, however, we live in an age of missiles, metascopes, multimeters, and meal combat, individual. While the basic mission remains the same, the policies and procedures, concepts and constraints have changed as drastically as the items of materiel involved. Truly global commitments, increased equipment complexity, and prolonged leadtimes in producing, procuring and positioning materiel add new dimensions and dilemmas to support planning.

Thus, a convergence of pressures -- internal and external, old and new, operational and administrative -- is focusing attention on readiness and response. An important part of the answer to this challenge is War Reserve Materiel (WRM).

War Reserves are formally defined by DOD as, "Stocks of materiel amassed in peacetime to meet the increase in military requirements consequent upon an outbreak of war. War reserves

are intended to provide the interim support essential to sustain operations until resupply can be effected." [5:370] This support mission, referred to as the "D to P concept," plugs the gap between D-day when operations commence and P-day when production has adjusted to keep pace with mobilization demand.

While relatively simple in purpose, war reserve systems are staggering in scope, encompassing the complete spectrum of logistics functions from item selection to warehousing and handling. War reserve programs must also be engineered and executed within the broader context of rapid mobilization and deployment to counter hostilities or perform vital contingencies. Such tradeoffs as materiel versus mobility and hardware versus holding cost complicate war reserve management and compete for limited resources in the defense budget. What decisions should be made is usually obvious. What decisions can and must be made is never easy.

B. A TOP-DOWN EXAMINATION

The materiel heart of any war reserve system is the War Materiel Requirement (WMR). The WMR is inseparably bound to and indeed driven by the ongoing intelligence estimates of the Joint Chiefs of Staff (JCS). Various documents developed within the framework of the JCS Joint Strategic Planning System (JSPS) provide (1) a military appraisal of threats to the nation, (2) recommended military objectives to support national policy, and (3) strategic proposals to attain and

sustain the interests of the United States. Estimates and recommendations for required fiscal, manpower and materiel resources are also included.

The Consolidated Guidance (CG) is an integral part of the DOD Planning, Programming and Budgeting System (PPBS) and is issued to the military services by the Secretary of Defense. The CG translates JSPS documents into specific contingencies, force levels and planning constraints, also considering the policies and politics of the current administration. Stated assumptions regarding such factors as the reaction time to respond to a mobilization order or the sustainability and intensity of combat can alter materiel requirements as much or more than the scope or peculiarities of a given mission assignment. Past guidance has specifically authorized the separate military services to determine their own best methods for calculating war reserve needs. This authorization most likely stems from variances in readiness requirements, size and nature of war reserve stocks and specific mission and geographical assignments.

Following receipt of the CG, the Commandant of the Marine Corps (CMC) develops Planning and Programming Guidance (PPG) which prescribes materiel support objectives and serves as a basis and authority for calculating war materiel requirements. Figures 2-1 and 2-2 illustrate the war reserve concept, utilizing approved definitions from the Department of Defense

WAR RESERVE MATERIEL CONCEPT

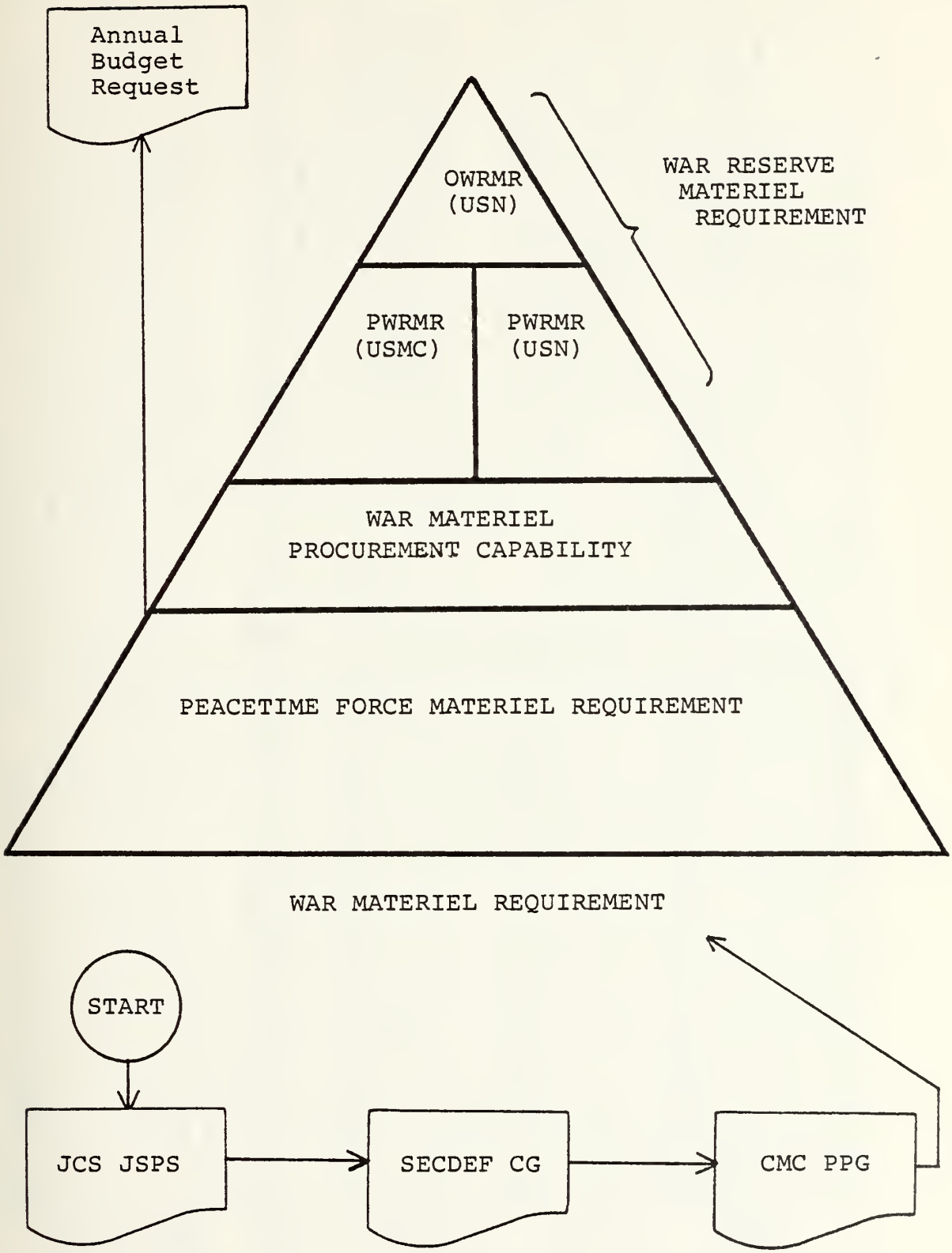


Figure 2-1

CATEGORIES OF WAR MATERIEL

A. WAR MATERIEL REQUIREMENT (WMR) - The quantity of an item required to support the approved U.S. force structure and those Allied forces specified for inclusion in U.S. materiel support planning, through the period prescribed for war materiel planning purposes. It includes the materiel required to equip and provide a materiel pipeline for the M-day forces (authorized peacetime forces, both active and reserve, on M-day minus one day), to support planned mobilization and to sustain in training, combat and combat support operations all U.S. and allied forces designated in current Secretary of Defense guidance.

B. WAR MATERIEL PROCUREMENT CAPABILITY (WMPC) - The quantity of an item which can be acquired by orders placed on or after M-day from industry or from any other available source during the period prescribed for war procurement planning purposes.

C. PEACETIME FORCE MATERIEL REQUIREMENT (PFMR) - The quantity of an item required to equip, provide a materiel pipeline and sustain the U.S. force structure (active and reserve) and those Allied forces designated for U.S. peacetime support in current Secretary of Defense guidance including approved supply support arrangements with foreign military sales countries, and support the scheduled establishment through normal appropriation and procurement leadtime periods.

D. WAR RESERVE MATERIEL REQUIREMENT (WRMR) - The quantity of an item in addition to the M-day force materiel requirement, required to be in the military supply system on M-day in order to support planned mobilization, to expand the materiel pipeline, and to sustain in training, combat and combat support operations the approved U.S. force structure and those Allied forces designated for U.S. materiel support through the period and at the level of support prescribed for war materiel planning purposes.

E. PRE-POSITIONED WAR RESERVE MATERIEL REQUIREMENT (PWRMR) - That portion of the war reserve materiel requirement which approved plans dictate to be positioned prior to hostilities, at or near the point of planned use or issue to the user, to ensure timely support of a specific project of designated force during the initial phase of war, pending arrival of replenishment shipments.

F. OTHER WAR RESERVE MATERIEL REQUIREMENT (OWRMR) - The war reserve materiel requirement less the sum of all pre-positioned war reserve materiel requirements.

Figure 2-2

Dictionary of Military and Associated Terms to identify specific materiel categories. Taken in toto, these various groupings represent DOD's materiel needs to wage war.

War Materiel Requirements for the approved support period are calculated on an item by item basis for each major operating unit. Separate formulas are used for computing requirements for reparable items, consumable items, and end items defined as follows:

> (1) reparable item - an item which can be reconditioned or economically repaired for reuse when it becomes unserviceable. [5:291]
>
> (2) consumable (expandable) item - an item which is consumed in use, such as ammunition, or which loses its identity such as some repair parts, or which is of low intrinsic value unworthy of full accounting procedures. [5:130]
>
> (3) end item - a final combination of end products, component parts, and/or materials which is ready for its intended use, e.g., ship, tank, mobile machine shop, aircraft. [5:125]

"The WMR is offset by peacetime assets expected to be on-hand on D-day and by the War Materiel Procurement Capability (WMPC). These two elements are flexible in that they may offset all, none, or a part of the WMR." [4:B-1]

The War Reserve Materiel Requirement (WRMR) for an item represents that portion of the WMR which is not offset by the Peacetime Force Materiel Requirement (PFMR) or the WMPC. As shown, WRMR assets may be prepositioned with units of the Navy and Marine Corps, or held within the Navy in other-than a prepositioned status.

In analyzing the WMR it is essential to realize that the several categories (1) contain the same types of items, (2) are offsetting and dynamic, and (3) are inextricably related. Nevertheless, each category is separately and, in some cases, differently managed, and imbalances within or between categories are common.

C. ORGANIZATIONAL RESPONSIBILITIES

Management of war reserves can be described as a system within a system, realizing that both DOD and the Marine Corps provide detailed policy and procedures for daily supply operations. An understanding of war reserves and the war reserve materiel pipeline requires an appreciation of the organization for logistics and supply.

The Marine Corps supply system relative to war reserves consists of three distinct functional areas, including (1) Headquarters Marine Corps, (2) the Marine Corps Inventory Control Point (ICP), and (3) the Fleet Marine Force (FMF) and related retail supply organizations. Wholesale level in this context includes assets and inventories which are controlled by the ICP and are available for redistribution. Retail organizations handle intermediate and/or consumer levels of inventory located near the ultimate users. [6:2-2]

The Commandant of the Marine Corps has ultimate responsibility for the total performance of the supply system and the readiness of the service. In keeping with the concept

of staff functioning, authority for the administration and operational management of the war reserve program is delegated to subordinate offices and activities. The Deputy Chief of Staff for Plans and Operations (DC/S P&O) formulates war reserve program objectives in terms of force missions, troop strength, and method and duration of employment. Acting along with the Division of Requirements and Programs, DC/S P&O publishes the annual war reserve guidance developed during the PPBS cycle.

The Deputy Chief of Staff for Installations and Logistics (DC/S I&L) is the Commandant's principal advisor on logistics matters, and is responsible for plans and policies, materiel program objectives, and materiel readiness. I&L is the appropriations sponsor for Procurement Marine Corps (PMC) and Operations and Maintenance Marine Corps (O&MMC) funds which are used to acquire and support major items. Additionally, this department oversees integrated logistics support planning and life cycle management of all major equipment. Procurement, materiel standardization, equipment modification, and requirements determination are I&L duties. This department is the Marine Corps interface with other components, services and agencies within DOD.

Relative to war reserves, I&L provides procedural guidance and sets priorities for asset attainment. This department provides input to the PPBS cycle for acquisition and replenishment, and monitors and reports the status of the war

reserve program in terms of requirements, attainments and deficiencies. Annual guidance published by P&O is implemented by I&L.

Other staff offices such as Aviation, Fiscal, Research and Development, and Data Processing provide support within their own areas of cognizance and expertise.

The wholesale activities within the supply system include those organizations, assets, and functions which are controlled by the single Marine Corps ICP co-located with the Logistics Base at Albany, Georgia. Specific responsibilities of the ICP include: [7:1-9]

(1) Computation of materiel requirements
(2) Preparation of budget estimates and exhibits
(3) Procurement actions
(4) Disposal actions
(5) Inventory management
(6) Cataloging
(7) War reserve management
(8) Technical direction of subordinate activities

The ICP is responsible for the day-to-day management of the war reserve system, including providing technical assistance to the FMF in requirements determination, and asset control, positioning, rotation and issue. Marine Corps requirements for war reserve stocks of commodities managed by other services and agencies are computed and consolidated by the ICP and registered with the appropriate manager. Subsequent attainment actions and status are monitored at the ICP.

The Marine Corps Logistics Bases at Albany, Georgia and at Barstow, California are the workhorse establishments of

the system. Under the technical direction of the ICP, these bases execute the broad functions of storage, maintenance, care-in-storage, and physical distribution of materiel assets.

The third segment of the supply system is composed of the FMF, including Division, Wing, and Force Service Support Group (FSSG) units. The FSSG is a relatively new concept in centralized combat service support which can function in forward areas along with a full infantry division and aircraft wing, or provide detachments to smaller amphibious task forces. The FSSG serves as a link between the wholesale activities and the using units, and performs the functions normally associated with a retail supply activity. Among other logistics support duties, the FSSG performs the total range of inventory management functions. Relative to war reserves, the FSSG maintains mount-out blocks of reserve stocks in a protected status to support the associated FMF task force. Maintenance, stock rotation, inspection and replacement are the responsibility of the FSSG, subject to close control from higher headquarters.

Each independent battalion, squadron or separate company has an organic supply and maintenance capability which is augmented by the FSSG. Because the General and Special Accounts within the FSSG retain physical custody of war reserves until deployment, division and wing responsibility is limited to developing logistics plans for assigned missions and reviewing the adequacy of WRMRs generated by the ICP.

Figure 2-3 is a recapitulation of the supply and war reserve duties of each level of organization.

D. COMMODITY MANAGEMENT RESPONSIBILITIES

While the full range and depth of supplies designated as PWRMRs must be acquired and positioned within the Marine Corps, significant OWRMR requirements are attained and held by the Navy. This materiel is concentrated in several supply classes as indicated in Figure 2-4, and mainly consists of aviation-peculiar items, medical supplies, common items of petroleum, oil and lubricants, and certain types of food stores. For these classes and subclasses requirements are estimated at the ICP and passed to the appropriate item manager in the Navy.

E. ASSET POSITIONING

War reserve assets are positioned with using units, support units, retail supply activities, and at the wholesale level. Common considerations in positioning materiel include:

(1) Response times for contingency operations,
(2) Shipping time,
(3) Transportation requirements and resources,
(4) Physical storage and maintenance requirements,
(5) Stock rotation opportunities.

After positioning, war reserve supplies can be categorized as shown in Figure 2-5.

This chapter has presented the basic war reserve concept and mission. It is within this framework that a search for

ORGANIZATIONAL SUPPLY AND WAR RESERVE RESPONSIBILITIES

SUPPLY	WAR RESERVE
HEADQUARTERS	
1. Formulates and supervises supply and fiscal plans, policies, objectives and programs	1. Develops plans, policies, and objectives
2. Budget formulation and execution	2. Publishes PPG
3. Integrated logistics support and life cycle management	3. Sets asset attainment priorities
4. Logistics coordination with external units	4. Measures and reports status
	5. Coordinates with external units
	6. Industrial Preparedness Planning
ICP AND WHOLESALE LEVEL	
1. Integrated materiel management	1. Calculates WRMRs
2. Requirements determination	2. Submits requirements to other managers
3. Central accounting	3. Measures and reports status
4. Technical operations	4. Storage and maintenance
5. Inventory control	5. Distribution
6. Procurement	
7. Storage and maintenance	
8. Distribution	
9. Depot level maintenance	
FMF AND RETAIL LEVEL	
1. Inventory management	1. Funds, positions, stores and maintains WRM
2. Supply accounting	2. Supply accounting
3. General and Special accounts	3. Measures and reports status
4. Organic supply support	4. Develops logistics plans
	5. Reviews WRMRs

Figure 2-3

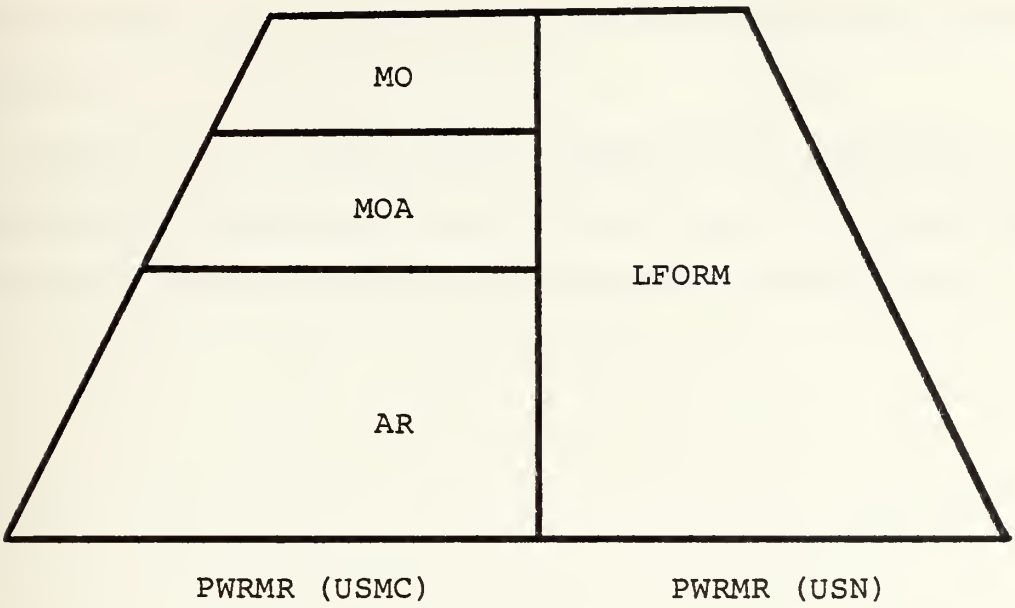
CLASSES OF SUPPLY

CLASS		SUBCLASS
I.	Subsistence	C-Combat rations R-Refrigerated stores * S-Nonrefrigerated * stores (less C)
II.	Clothing, individual equipment, organizational tools, administrative and housekeeping supplies and equipment	B-Ground support matl. * E-General supplies F-Clothing and textiles M-Weapons T-Industrial supplies
III.	Petroleum fuels, lubricants, oils, gases, bulk chemicals, coolants, preservatives, additives, and coal	A-Aviation * W-Ground (Surface)
IV.	Construction, fortification, and barrier materiel	
V.	Ammunition, including special weapons (nuclear, chemical, and biological), bombs, mines, fuzes, detonators, missiles, explosives, pyrotechnics and propellants	A-Aviation * W-Ground
VI.	Personal demand items	
VII.	Major end items - combinations of products ready for their intended use	A-Aviation * B-Ground support matl. * D-Admin vehicles G-Electronics K-Tactical vehicles L-Missiles M-Weapons N-Special weapons
VIII.	Medical materiel*	
IX.	Repair parts and components including kits, assemblies and subassemblies, reparables and consummables required for maintenance support	A-Aviation * B-Ground support matl. * D-Admin vehicles G-Electronics K-Tactical vehicles L-Missiles M-Weapons N-Special weapons T-Industrial supplies

*Denotes classes and subclasses managed by the U. S. Navy

Figure 2-4

CATEGORIES OF PREPOSITIONED WAR RESERVES



MOUNT-OUT (MO) - That quantity of equipment and supplies required to sustain an FMF unit for the initial 30 days of combat operations. All MAFs acquire and maintain mount-out.

MOUNT-OUT AUGMENTATION (MOA) - The second 30 day increment of stock to support an FMF unit in combat operations. MOA is held at the wholesale level for forces stationed in the U.S. while III MAF in Okinawa, Japan is authorized to acquire and maintain MOA due to distance and time factors.

AUTOMATIC RESUPPLY (AR) - The remaining war reserve assets held in a protected status at the wholesale level to support FMF combat operations. This term is a carry-over from earlier periods when all reserves were configured into identical 30 day blocks which were automatically "pushed" into forward areas on an established schedule. Today, items are "pulled" out of the war reserve system by requesting units. Though somewhat anachronistic, the term is useful in distinguishing war reserve assets held at the wholesale level.

LANDING FORCE OPERATIONAL RESERVE MATERIEL (LFORM) - Items of PWRMS prepositioned aboard amphibious shipping, primarily in supply classes III and V.

Figure 2-5

improved performance and potential savings should begin. While tradeoffs can be made between cost, readiness, and performance, the consequences of such actions must be made explicit.

Chapters 3, 4, and 5 will examine item selection criteria, requirements determination, and replacement factors, while subsequent chapters explore management alternatives.

III. ITEM SELECTION CRITERIA: THE RANGE OF SUPPORT

The foundation of the war reserve system is the selection of those items which qualify for stockage. Readiness and economy demand that the selection process accurately identify required items while screening out non-essentials.

This chapter will critique current procedures and discuss the concept of combat essentiality.

A. CURRENT SELECTION CRITERIA AND PROCEDURES

Figures 3-1 and 3-2 display the criteria contained in the Marine Corps War Reserve Policy Manual, arranged in a logical screening sequence. Qualification for stockage is a two-step process in which an item must satisfy one or more of the positive criteria while not violating any negative or exclusion criterion. Figure 3-2 notes that production and procurement difficulties cannot qualify an item for stockage, but should be weighed in applying the other criteria, and in related management decisions.

The screening process reflects standard DOD policy, and would certainly appear to not only permit, but inevitably result in varying interpretations and decisions. The criteria are general in nature, relying heavily on the experience and judgment of the technician in determining combat essentiality, relevant physical characteristics, and production and procurement peculiarities.

NEGATIVE SELECTION CRITERIA FOR WAR RESERVES

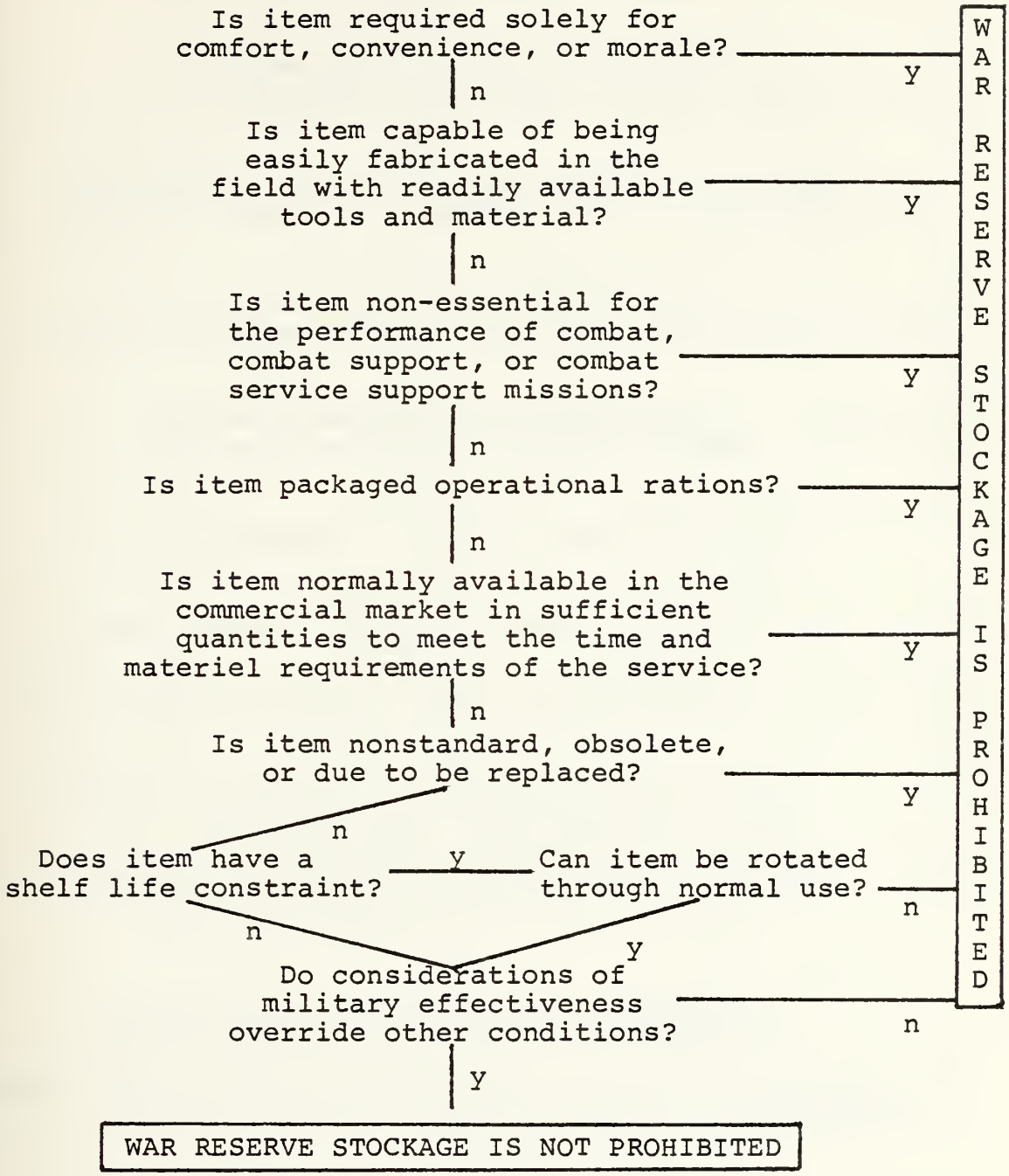
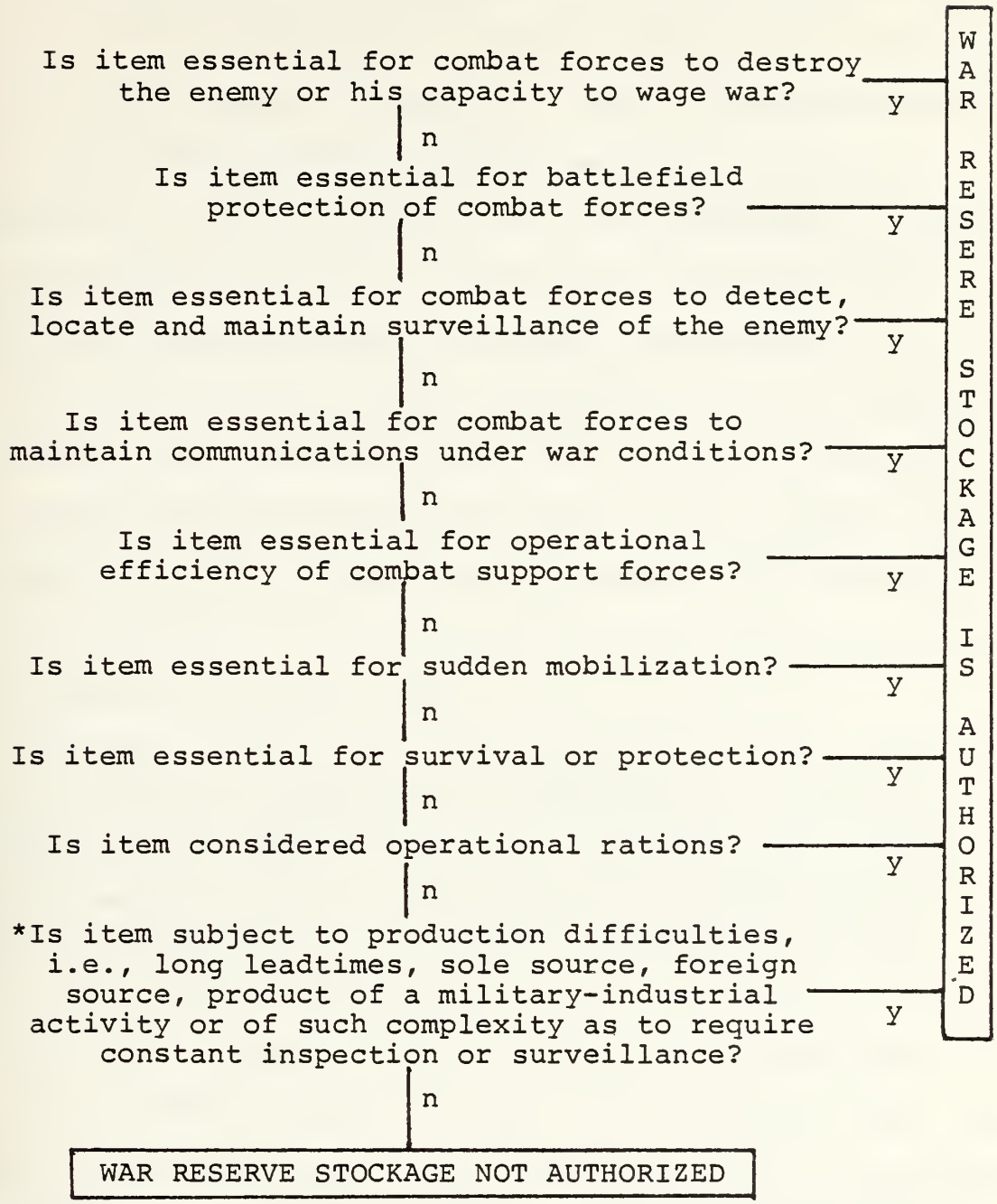

Is item required solely for comfort, convenience, or morale?
y
n
Is item capable of being easily fabricated in the field with readily available tools and material?
y
n
Is item non-essential for the performance of combat, combat support, or combat service support missions?
y
n
Is item packaged operational rations?
y
n
Is item normally available in the commercial market in sufficient quantities to meet the time and materiel requirements of the service?
y
n
Is item nonstandard, obsolete, or due to be replaced?
y
n
Does item have a shelf life constraint?
y
Can item be rotated through normal use?
n
n
y
Do considerations of military effectiveness override other conditions?
n
y
WAR RESERVE STOCKAGE IS NOT PROHIBITED
WAR RESERVE STOCKAGE IS PROHIBITED

Figure 3-1

POSITIVE SELECTION CRITERIA FOR WAR RESERVES


Is item essential for combat forces to destroy the enemy or his capacity to wage war?
y
n
Is item essential for battlefield protection of combat forces?
y
n
Is item essential for combat forces to detect, locate and maintain surveillance of the enemy?
y
n
Is item essential for combat forces to maintain communications under war conditions?
y
n
Is item essential for operational efficiency of combat support forces?
y
n
Is item essential for sudden mobilization?
y
n
Is item essential for survival or protection?
y
n
Is item considered operational rations?
y
n
*Is item subject to production difficulties, i.e., long leadtimes, sole source, foreign source, product of a military-industrial activity or of such complexity as to require constant inspection or surveillance?
y
n
WAR RESERVE STOCKAGE NOT AUTHORIZED
WAR RESERE STOCKAGE IS AUTHORIZED

*NOTE: This criterion alone will not justify stockage, but identifies items requiring special consideration.

Figure 3-2

For Class VII items the Marine Corps Acquisition Project Officer (APO) at Headquarters provides the ICP with critical management and support information early in the provisioning cycle. This information includes a measure of end item essentiality. The provisioner, with the assistance of other ICP and contractor personnel, assigns an appropriate code reflecting item criticality and combat essentiality.

Criticality codes indicate, "Whether or not there exists a critical, acute requirement for the item in its application to the end item to function properly."[8] Repair parts for combat essential and non-combat essential end items may be either critical or non-critical. Combat essentiality can be described as follows: [9:65]

> The basic factors that determine combat essentiality ... are urgency, compensability, and mission effectiveness. Urgency suggests the infeasibility of postponing a demand on the supply system ... Compensability refers to the ability to quick fix, substitute, cannibalize, or locally manufacture ... Finally the question is asked whether mission effectiveness would be adversely effected by the failure of the item under consideration, and if so, the item is designated as combat essential.

The ICP has recently combined combat essentiality and criticality codes. Figure 3-3 shows the latest revision. Of interest is the note that the code assigned for a new application is compared with the existing code in the information system, with the higher code being retained. Thus the single code resident in the system for the entire support quantity of a given item is the code for the most critical application.

COMBAT ESSENTIALITY/CRITICALITY CODES

Ø Non-Combat Essential End Item - End items that do not fit the definition of Code 1 items.

1 Combat Essential End Item - Items of equipment whose availability in a combat ready condition is essential for execution of the combat and training mission of the command.

2 Non-Critical Repair Part - Repair parts or major components whose failure in an end item will not render the end item inoperative or reduce its effectiveness below the minimum acceptable level of efficiency, and which do not fit the definition of Code 3 or 4 items.

3 Critical for Health and Safety of Personnel - Those parts and components that are required for the health and safety of personnel, and which do not fit the definition of Code 5 or 6 items.

4 Critical for State and Local Laws - Those parts and components which are required for conformance to state law or local ordinances, and which do not fit the definition of Code 5 or 6 items.

5 Critical Repair Part to a Combat Essential End Item - Those parts or components whose failure in a combat essential end item will render the end item inoperative or reduce its effectiveness below the minimum acceptable level of efficiency.

6 Critical Repair Part to a Non-Combat Essential End Item - Those parts or components whose failure in a non-combat essential end item will render the end item inoperative or reduce its effectiveness below the minimum acceptable level of efficiency.

NOTE: A comparison of the code for an NSN (National Stock Item) is made for each higher order equipment application within the Marine Corps supply system. The code actually recorded is the most critical numeric derived from the comparison.

Figure 3-3

B. EVALUATION OF CURRENT ITEM SELECTION PROCEDURES

The criteria presently in use do not differ significantly from those discussed by the Logistics Management Institute (LMI) in a comprehensive study of DOD war reserves. LMI criticism included: [10:22-23]

> (1) The criteria are general in nature and subject to the judgments of the military services and individual commanders.
>
> (2) The criteria do not link selection of an item for war reserve stockage to a specific need in a specific assigned contingency.
>
> (3) The current criteria do not address conditions which are likely to prevail during the initial combat period. Handling, storage, transport and repair constraints may eliminate candidate items which appear to otherwise qualify.
>
> (4) Many of the criteria refer to a measure of item essentiality which simply has not been quantified.

Despite these shortcomings, LMI concludes that: [10:80-81]

> The war reserve selection criteria ... cannot be significantly improved by more definitive criteria of a qualitative nature ... The most significant improvements ... can be achieved by establishing uniform policies and consistent methods for computing war reserve requirements.

GAO studies have commented on the lack of specificity in the annual Secretary of Defense guidance and the overuse and abuse of high criticality codes as causes of waste and inefficiency. Commenting on the Air Force, they stated, "All five of the Air Logistics Centers have at least 81% of the items they manage identified as highly critical." [11:ii]

The next section will examine the elusive and ill-defined concept of item essentiality.

C. THE CONCEPT OF ITEM ESSENTIALITY

Determining essentiality involves analyzing an item with respect to its contribution to the success of a mission. Such an analysis must consider the operating environment, nature of the mission, extent of degradation in ability to perform if an item is lost, and the way in which the item interfaces with other items and equipment. An adequate treatment of these factors demands the same judgment and effort as is devoted to operating plans, task organizations, and tailored troop and equipment lists. Though inherently and unavoidably subjective, this process needs a common method and yardstick for applying it.

Essentiality depends not only on the mission but also on the organizational unit. Although a jeep or rifle is conceivably essential for any unit, under normal circumstances they would be less critical in a Supply Battalion than in the command element of an infantry unit. Essentiality is also a function of the number and status of similar items within the unit. The marginal effect of losing one truck is probably greater in an Artillery Battalion than in a Motor Transport Battalion.

GAO found that essentiality decisions in the Air Force were often made by individuals who were unfamiliar with the combat employment or importance of the item being procured. [11:iii] In this situation the normal reaction is to assign a code which will permit stockage. As noted in Figure 3-3,

such an improper coding in the Marine Corps would likely be recorded against and applied to all applications of the same item. Managers who calculate requirements are instructed to do so on an unconstrained basis, regardless of budget projections. Thus, an initially well-intended but ill-founded stockage qualification decision is compounded, and the individual or office tasked with prioritizing spending and asset attainment is truly confounded. It is indeed very easy to imagine a scenario where unnecessary items are procured while valid requirements go unfunded.

Figure 3-4 is a sample of the mission and task portions of an official Marine Corps Table of Organization. While more elaborate means of identifying and coping with the concept of essentiality are available, the T/O could be used to classify the importance of a unit's equipment relative to its assigned missions. Basing essentiality coding on representative missions of similar units may be a workable compromise to dealing with all the possible contingencies which face individual units. The concept of essentiality is further explored in Chapter VI, where spending priorities are discussed.

Given time, unlimited resources and adequate transportation, America's industrial base could probably overcome poor planning much as industrial might has decided major wars in the past. Today, however, all three commodities are

SAMPLE MISSION AND TASK STATEMENT

OF A MARINE WING SUPPORT GROUP

3. MISSION AND TASKS

a. Mission. Provide command, control, supply and logistics support for the squadrons of the group; motor transport support both medium and heavy, refueling support for both ground equipment and aircraft; engineer support and organizational maintenance (motor transport and engineer) for elements of the Marine Aircraft Wing.

b. Tasks

(1) Provide motor transport support (medium and heavy).

(2) Provide engineer equipment support.

(3) Provide materiel handling support.

(4) Provide refueling support for ground equipment and aircraft.

(5) Provide Tactical Airfield Dispensing Systems as required for MAW units.

(6) Provide camp construction and facilities maintenance for MAW.

(7) Provide organizational maintenance for motor transport and engineer equipment of MAW units.

(8) Provide mobile electric power for the MAW.

(9) Provide essential water and hygiene support in the area of portable water, bath facilities and laundry facilities for the MAW.

(10) Locate quarries, sand and gravel pits, and other sources of construction material in the objective area.

(11) Provide expedient/minor repair of existing airfields, runways/taxi ways.

(12) Conduct second echelon level maintenance of all organic engineer equipment.

(13) Provide materiel handling equipment for the MAW.

Figure 3-4

stretched and strained, and a workable concept of essentiality is needed to efficiently and effectively exploit available resources.

IV. REQUIREMENTS DETERMINATION: THE DEPTH OF SUPPORT

Requirements determination is an inseparable building-block companion to item selection. As before, accuracy, thoroughness and consistency are required to prevent waste or want.

This chapter will survey requirements determination methods for all classes of supply and types of items in hopes that variations in management procedures between different groupings may suggest solutions to problems in any single area.

A. CLASS I REQUIREMENTS

War materiel requirements for subsistence items would seem to be a simple function of the number of men involved in an assigned contingency and the number of days projected for either the combat operation or the establishment of a resupply pipeline. A dominant physical and policy consideration, however, is the three year shelf life of packaged operational rations. As a result, stock levels must not exceed quantities which can be rotated and consumed in normal peacetime training during the shelf life period.

As prescribed, a WMR is calculated for subsistence and offset by peacetime stocks on hand. The remainder represents the WRMR and is passed for planning purposes to the Defense Personnel Support Center of the Defense Logistics Agency.

Curiously, the ration supplement, sundries pack is not stocked during peacetime. Requirements for this item are registered directly with a civilian contractor. [4:2-3]

B. CLASS III REQUIREMENTS

The Marine Corps' primary source for common petroleum, oil, and lubricant (POL) items is the U.S. Navy. Requirements are centrally computed at Headquarters Marine Corps based on equipment densities and planning factors developed from historical usage data. This information is forwarded to the Navy. Quantities required for the first sixty days of combat are classified as PWRS while the remainder is registered as OWRS.

A certain portion of the PWRS is further designated as Landing Force Operational Reserve Materiel (LFORM) and prepositioned aboard amphibious assault shipping. War reserve stocks must also be classified as bulk or packaged POL to ensure that the products are received in a form which is compatible with the user's materiel handling capabilities.

Suggested planning factors for Marine Corps-peculiar oils, greases and lubricants are listed in the Table of Authorized Materiel (TAM) for each item of equipment. These factors are used by major force commanders along with equipment allowances to determine requirements. Mount-out levels of stock for sixty days are attained and held as PWRS at the retail supply level. The remaining WRMR is passed to

the ICP, procured, and positioned at the wholesale level.

This bottom-up calculation of requirements for peculiar items enables and encourages commanders to use their own judgment. The TAM invites, and indeed instructs that such factors as mission, environment, objective area and task organization be considered in deviating from listed consumption rates. While such factors equally effect consumption of common POL items, the variation relative to the absolute size of the requirement is small enough to permit centralized computation.

C. CLASS V REQUIREMENTS

Headquarters calculates the WMR for ground ammunition based on the approved force structure, weapons mix, and combat expenditure rates. [4:2-7] Force commanders review these calculations in light of their own specific assignments, recommending quantity changes and distribution between MO, MOA, AR, and LFORM. As a result of amphibious shipping shortfalls it is frequently necessary to preposition ammunition in forward areas with other services or allies. An initial sixty-day support requirement is planned for and positioned before any consideration of the WMPC.

Following the WMPC offset, the remaining WMR is likewise designated as PWRS. This stock is attained and controlled by Headquarters but normally stored at arsenals and ammunition depots of other services.

D. CLASS IX REQUIREMENTS

Repair parts and components required for maintenance support are divided into several categories, each with its own requirements determination procedure. These categories include consumable parts, reparables, critical low-density insurance items, and shelf life items.

Requirements for consumable repair parts are calculated at the ICP based on assigned replacement factors. These factors are derived from actual usage data or recommended by equipment manufacturers and specialists during the provisioning of a new item. As these factors represent peacetime conditions, a combat replacement factor of 1.75 is multiplied by the assigned replacement factor to determine WRMRs. [6:III-7] That portion of the WRMR designated as MO or MOA is positioned at the appropriate retail or wholesale level activity. Figure 4-1 illustrates the calculation of all three PWRS increments for consumable repair parts.

Calculations for reparable items differ slightly for using units, support units, or wholesale supply activities depending on the exact type and purpose of the inventory. Figure 4-2 is included to show the kinds of considerations which come into play in a typical calculation. Reparable parts are managed in a special account of the FSSG known as the Maintenance Float. The float coordinates repair of unserviceable items with the appropriate maintenance activity and maintains an inventory of reparables to support

MO, MOA, AND AR COMPUTATIONS FOR CONSUMABLE ITEMS

A = Annual Replacement Factor (1.75 x assigned replacement factor)

B = Applications per end item - the number of times a repair part is installed in an end item

C = End item density - how many of a particular end item are held by a given unit/task organization

$$MO = A \times B \times C \times \frac{30}{360}$$

$$MOA = A \times B \times C \times \frac{30}{360}$$

$$AR = A \times B \times C \times \frac{120}{360}$$

NOTE: This sample calculation assumes a standard support period of 180 days.

Figure 4-1

MO, MOA, AND AR COMPUTATIONS FOR REPARABLE ITEMS

MAINTENANCE FAILURE RATE - The annual rate of replacement of an unserviceable item. When more reliable engineering or maintenance data are not available, the replacement factor of every independent repair part and assembly comprising the reparable item are totaled to determine the MFR of the reparable.

REPAIR RATE - The fractional quantity of MFR anticipated to be repaired each month. Maintenance and repair data reported by the FMF for the same or similar items are considered in determining the RR. In the event that empirical maintenance and repair data are not available, data provided by maintenance engineering analysis reports or engineering data obtained from the provisioning list and engineering staff of the contractor are considered. In the absence of empirical data a standard 90% RR is applied.

REPAIR CYCLE TIME - The total elapsed time from removal of the reparable item that has failed until the return of the item to the maintenance float in a serviceable condition. This time includes removal, in-transit, under inspection, awaiting parts, under repair, and other stages.

RESUPPLY RATE - The fractional quantity of MFR anticipated to be "washed out" each month and to require replacement by requisitioning from the normal source of supply. The RSR is the MFR less the RR quantity. In the absence of any data a standard 10% RSR is applied.

DAY LEVEL AUTHORIZED - The number of days of supply authorized. Maintenance Float accounts are presently authorized 30 days in the United States and 60 days overseas.

$$MO = (RR\ QTY \times \frac{RCT}{30}) + (RSR\ QTY \times \frac{DL}{30})$$

$$MOA = RSR\ QTY$$

$$AR = (RSR\ QTY) \times (\#MONTHS\ SUPPORT\ @\ WHOLESALE\ LEVEL)$$

Figure 4-2

using units in a direct-exchange fashion.

Present policy provides for deviating from the standard formulas to ensure minimum stockage of critical low-density items. When a thirty-day usage level fails to authorize at least a quantity of 1 for such items, 180 and 360 day levels are calculated. If a requirement is still not indicated, one item is authorized for stock. Critical items are specifically designated as such by Headquarters.

E. CLASS II, IV, AND VII REQUIREMENTS

These classes are discussed as a group because of their identifical treatment in the TAM. Within the TAM, items in these classes are categorized as follows:

(1) Type 1 - items which appear in a unit's official table of equipment (T/E) and which are considered mandatory allowances to be kept on-hand or on-order at all times. Type 1 items are normally funded by Headquarters.

(2) Type 2 - items of materiel for which the T/E allowance is considered a guide. Specific mandatory allowances are determined by the force commander and items are funded at the local level.

(3) Type 3 - special purpose equipment such as arctic and desert environmental items and field fortification materiel. These supplies are not authorized for procurement and are maintained and issued out of central training allowance pools during peacetime.

The type designation in the TAM and the class of supply significantly effect how an item is managed and how war reserve levels are calculated.

Type 1 items are considered essential for combat operations. Authorization to compute and acquire war reserve stock is indicated in the TAM by the assignment of a Combat Active Replacement Factor (CARF). "The CARF reflects usage incident to amphibious operations and other combat operations normal to the FMF and is a representation expressed in monthly increments of the combat life expectancy of the equipment." [12:XX] A second class of war reserve TAM items consists of entries with a Combat Support Stock Requirement (CSS RQ). Items having a CSS RQ are identified with a Y. Force commanders are responsible for determining and procuring MO levels of class II type 1 equipment in these categories. Follow-on PWRS for class II type 1 and all levels of class VII type 1 are calculated and managed by the ICP. Figure 4-3 is a sample page from the TAM showing CARF and CSS RQ items.

Type II items in classes II, IV, and VII which qualify for war reserve stockage are also indicated by assignment of a CARF or CSS RQ. As with type 1 items, force commanders compute and attain MO allowances for classes II and IV, while the ICP controls MOA, AR, and all levels of class VII.

War reserve requirements for type 3 items with a CARF or CSS RQ are computed by the ICP. Calculations for class

TAM PAGE WITH CARF AND CSS RQ

TABLE OF AUTHORIZED MATERIEL

TYPE 1 ITEMS

MOTOR TRANSPORT ITEMS

TAMCN	NOMENCLATURE	REPLACEMENT FACTORS FOR 30 DAYS CARF	MTRF	PTRF	CSS RQ
D1030VIIK	TRUCK, CARGO, DROPSIDE, 2 1/2 TON 6 X 6 M35A2C	.0200	.0050	.0050	N
D1040VIIK	TRUCK, CARGO, 2 1/2 TON 6 X 6 M36A2	.0100	.0050	.0050	N
D1050VIIK	TRUCK, CARGO, 5 TON 6 X 6 M54A2C	.0240	.0040	.0075	Y
D1060VIIK	TRUCK, CARGO, 5 TON 6 X 6 M55A2	.0240	.0040	.0075	N
D1062VIIK	TRUCK, CRASH/FIRE/RESCUE 4 X 4 M-1000	N/A	N/A	N/A	N
D1065VIIK	TRUCK, CRASH, FIRE AND RESCUE 6 X 6 MB-1	N/A	N/A	N/A	Y

NOTE: The following data elements included in the TAM are omitted from this extract, (1) Weapons System Code, (2) National Stock Number, (3) Item Designator Number, (4) Unit of Issue, (5) Unit Standard Package, (6) Unit Standard Package Cube, (7) Unit Standard Package Weight, and (8) Square Storage Requirement

Figure 4-3

II and IV are reviewed by the force commanders, who recommend quantities to be positioned within the FMF. Remaining quantities are held at the wholesale level. All class VII assets are managed by the ICP.

This overview of the requirements determination process for each class clearly shows that a variety of different methods does exist, reflecting special circumstances and constraints. Attempts to improve performance in one area should logically look at other areas for feasible alternatives. Some key across-the-board assumptions such as the use of a 1.75 acceleration figure for combat factoring of consumables, deserve closer analysis. Additionally, initial allowances which in combination with replacement factors drive WRMR calculations, deserve attention, but are beyond the scope of this study.

Chapter V will further address the requirements determination process by looking at replacement factors.

V. REPLACEMENT FACTORS

A. THE HISTORICAL USE OF REPLACEMENT FACTORS

The requirements determination process is driven to a large degree by initial unit allowances and replacement factors. Stanford Research Institute (SRI) states, "The Marine Corps has used combat active replacement factors (CARFs) for years as a mathematical tool for determining requirements for supplies and equipment to replace anticipated losses in combat." [13:1]

Initially, CARFs were used by FMF units to compute ready-for-deployment stocks to be held as mount-out, and by the ICP to calculate replenishment quantities.

> Over the years there has been a gradual centralization of the process for determining WMR, including the central computation of mount-out requirements; HQMC and the Marine Corps Logistics Base (MCLB) at Albany, Georgia have assumed the major roles. As a consequence, the FMFs are now less directly involved with CARFs and are more concerned with the review of centrally computed requirement quantities for their specific missions, operational requirements and contingencies. [13:7]

A Replacement Factor Review Board was established at Headquarters in 1962 to approve initial assignments and periodically review planning factors. The board's primary concerns were in identifying equipment which would likely be used in combat, and in estimating attrition.

No significant changes in the process took place until 1971 when a major program review led to the reduction or

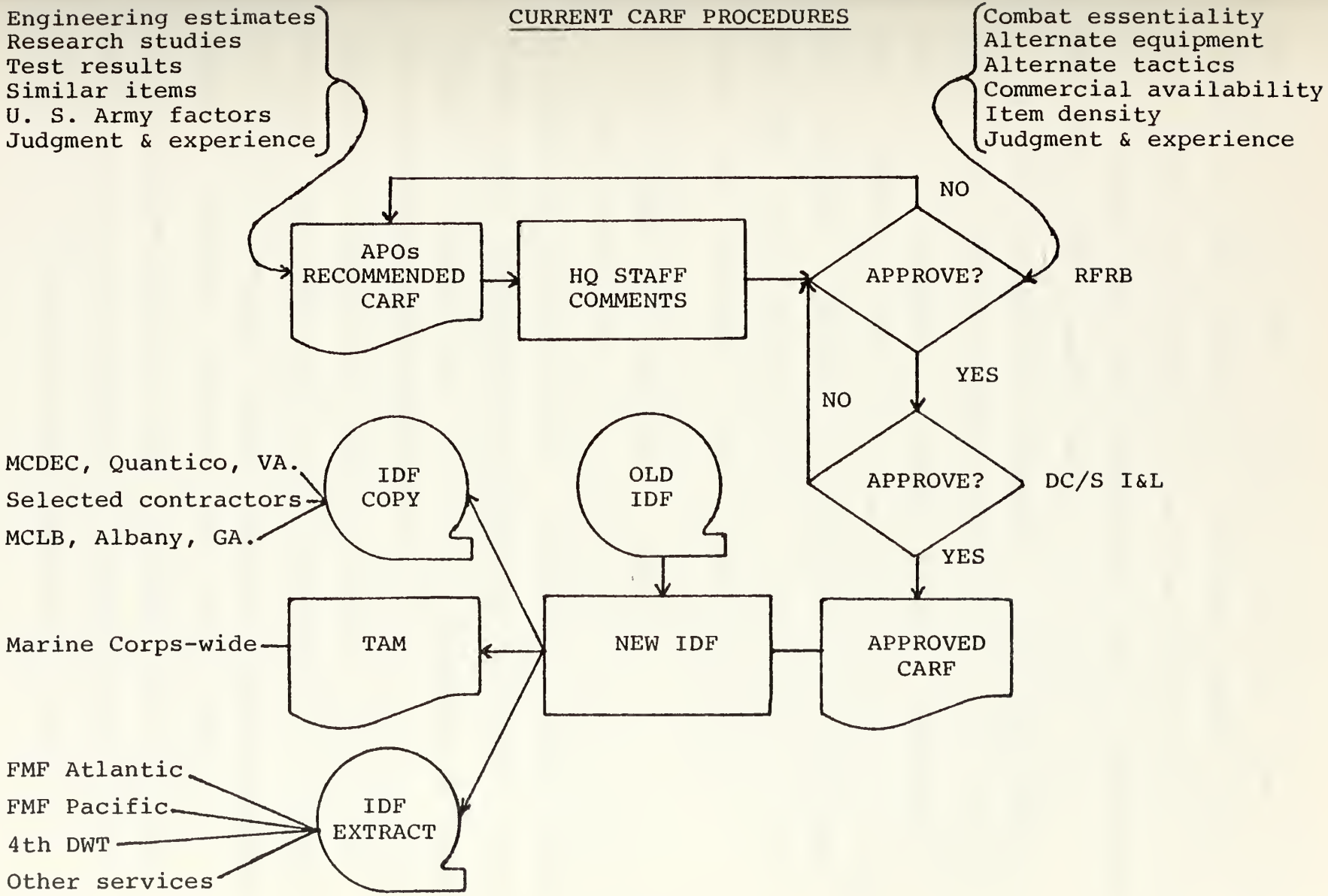

CURRENT CARF PROCEDURES
Engineering estimates
Research studies
Test results
Similar items
U. S. Army factors
Judgment & experience
Combat essentiality
Alternate equipment
Alternate tactics
Commercial availability
Item density
Judgment & experience
APOs RECOMMENDED CARF
HQ STAFF COMMENTS
APPROVE?
NO
RFRB
YES
NO
APPROVE?
DC/S I&L
YES
MCDEC, Quantico, VA.
Selected contractors
MCLB, Albany, GA.
IDF COPY
OLD IDF
Marine Corps-wide
TAM
NEW IDF
APPROVED CARF
FMF Atlantic
FMF Pacific
4th DWT
Other services
IDF EXTRACT

Figure 5-1

deletion of many CARFs. Looking for the first time at such factors as combat essentiality, alternate weapons and tactics, commercial availability and item density within likely task organizations, the board adjusted factors and decreased the overall WMR by nearly one billion dollars. [13:8]

In the late seventies weaknesses in the CARF system, including the absence of CARFs for many items, again focused attention on the process. Several expedient adjustments were made to shore-up readily perceived shortcomings, and a study was contracted to develop a new methodology and determine new CARFs. These recent actions, as well as current procedures, are discussed in the following sections.

B. THE CURRENT CARF PROCEDURE

Figure 5-1 depicts the current Marine Corps procedure for assigning and approving CARFs. Acquisition Project Officers (APOs) within the commodity branches of the Materiel Division formulate recommendations for initial assignments or changes. The basis for such recommendations includes a broad assessment of the component and system in question, their peculiarities, and their physical and performance characteristics. Documentation from previous and on-going research and development is considered, along with the factors assigned to similar systems and/or by other services. The collection, careful analysis and integration of this data are heavily dependent on the experience and expertise of the APO.

Additionally, the fiscal condition of the project may cause the APO to identify initial attainment quantities of materiel which are less than the full support requirement. While such a condition is unfortunate, the possible alternative of "low-balling" a CARF to match apparent requirements with available funds could prove disastrous. Though a primary proponent of his assigned system, the APO is graded on timely acquisitions within allotted budgets, and not on long term effectiveness.

The APO's recommendation is staffed through various divisions and departments at Headquarters and passed with comments to the Replacement Factor Review Board. SRI points out that Headquarters reorganizations in the mid-1970's undermined the traditional membership and chairmanship of this board. Reestablished in 1977, the board has formalized procedures and borrowed heavily from the U.S. Army wartime replacement factor system (WARFs). WARFs are derived from a combination of war gaming, attrition modeling, and historical usage data. Nevertheless, two primary factors have significantly hampered the board: (1) the absence of a clear audit trail reflecting the rationale behind previously assigned CARFs, and (2) a lack of quantitative methods, making the board heavily dependent on experience and subjective judgement.

Following approval by DC/S I&L, CARFs are input into the Item Data File (IDF) of the Logistics Management Information System (LMIS). Once updated, IDF information is passed

to various users in the TAM, tailored file extracts, or in complete file copies.

While the resurgence of interest in CARFs bodes well for the future, it has created several imbalances and inconsistencies in the present. During the Program Objective Memorandum (POM) phase of the 1980 budget process a transition from one to four rates per item was begun. This project is grounded in the realization that different types of threats in different geographic locations certainly mean different attrition rates and operational demands on equipment. The four factors include: [13:9]

> (1) Europe Intense - factor applied to determine requirements for units committed to the European theater during a period when intense combat is anticipated.
>
> (2) Europe Sustained - factor applied to determine requirements for units committed to the European theater during periods of other than intense combat.
>
> (3) World-wide Intense - factor applied to determine requirements for units committed outside of Europe during a period when intense combat is anticipated.
>
> (4) World-wide Sustained - factor applied to determine requirements for units committed outside of Europe during periods of other than intense combat.

Converting to the four-rate approach in an orderly fashion requires data which is simply not available. Faced with this predicament, the Marine Corps substituted NATO Intense and NATO Sustained WARFs for the European theater, while scaling down these same figures to arrive at world-wide factors.

For items lacking analogous Army rates, the following scheme was used: [13:10]

(1) Europe Intense = 2 x Old CARF

(2) Europe Sustained = 3/4 x Old CARF

(3) World-wide Intense = 1 x Old CARF

(4) World-wide Sustained = 2/3 x Old CARF

The troublesome, if temporary result of these machinations is an IDF with four factors which interfaces with a TAM and several logistics models geared to deal with a single CARF.

C. EVALUATION OF CARF PROCEDURES

The preceding overview of current CARF procedures clearly shows the impetus for and importance of the SRI study. An interim report issued in February of 1980 highlights the following points: [13:3-4]

> (1) The current USMC methodology for determining CARFs is inadequate. It is largely based on judgmental criteria, with some degree of reliance on the Army. Traditionally it has not enjoyed a scientific basis for decision making. In addition, it does not capture and save loss data generated from the fragmented sources of studies, field exercises, peacetime usage, and combat history.
>
> (2) There is a need to differentiate between combat active attrition rates (CAARs) and CARFs. Combat active attrition rates reflect that amount of materiel which the USMC can anticipate losing in combat. Combat active replacement factors indicate that amount of materiel which will be replaced in combat. CARFs may be subject to practical considerations concerning actual replacement in combat.
>
> (3) The only service with a quantitative methodology for determining losses is the Army, but its direct applicability to the USMC is limited. ... The associated land-combat processes do not necessarily reflect amphibious operations.

(4) There is no universally accepted methodology for modeling attrition in combined arms combat. Moreover, none is foreseeable. No one methodology has enough scope and breadth to detail all attrition processes and sources.

(5) Attrition models must be augmented by additional research tools. In order to support the decision process, simulations, field exercises, study results and history must be combined with sound military judgment and experience.

Despite the inherent difficulties in developing and implementing an adequate CARF system, the value of the effort is beyond reproach. Similar to the LMI conclusion regarding item selection, uniform application of a procedure for determining replacement factors is of greater importance than the technical accuracy of the selected procedure.

With initial allowances, a requirements determination process, and replacement factors, planners can estimate needs. The next step in war reserve management is to establish budget and spending priorities to attain the assets to meet these needs.

Section D provides additional information on the U.S. Army WARF process.

D. THE U.S. ARMY WARF PROCEDURES

The Army's wartime replacement factor (WARF) procedures are used to develop consumption rates for major combat items in a European, nonnuclear combat scenario. Loss and consumption rates have traditionally been derived from actual historical data. Resultant factors unavoidably reflect past

experience and are of questionable value when applied to new equipment, technology, tactics, and combat situations. In 1964 the Army began work on SYMWAR - a System for Estimating Materiel Wartime Attrition and Replacement Requirements. While the latest SYMWAR methodology reflects changing intelligence estimates and an expanding simulation and war-gaming capability, the basic concept has not changed.

SYMWAR is an interactive matrix system which considers three conditions, including (1) 10 causes of loss, (2) 4 combat postures of the force, and (3) 5 location zones relative to the area of frontline operations identified by the Forward Edge of the Battle Area (FEBA). Figure 5-2 lists these conditions and elements, while Figure 5-3 displays a SYMWAR loss matrix. A separate matrix is generated for each of 36 classes of combat items grouped as a result of similar design, operating, repair, and vulnerability characteristics. Each class is represented in the actual computation of WARFs by a notional item which typifies the class. Figure 5-4 is a listing of the classes currently in use.

The original SYMWAR model was heavily dependent on historical data from World War II and Korea. Under WARF, the cells identified by dashes in Figure 5-3 are calculated by simulation and gaming as changes in the weaponry, mobility, target acquisition capability and tactics have undermined the applicability of historical data. [14:3-1] For these

SYMWAR MATRIX ELEMENTS

Causes of loss

Direct Fire
Area Fire
Bombing
Strafing
Battle Loss (abandonment)
Pilferage
Mines
Wearout
Guerrilla
Accident

Location zones

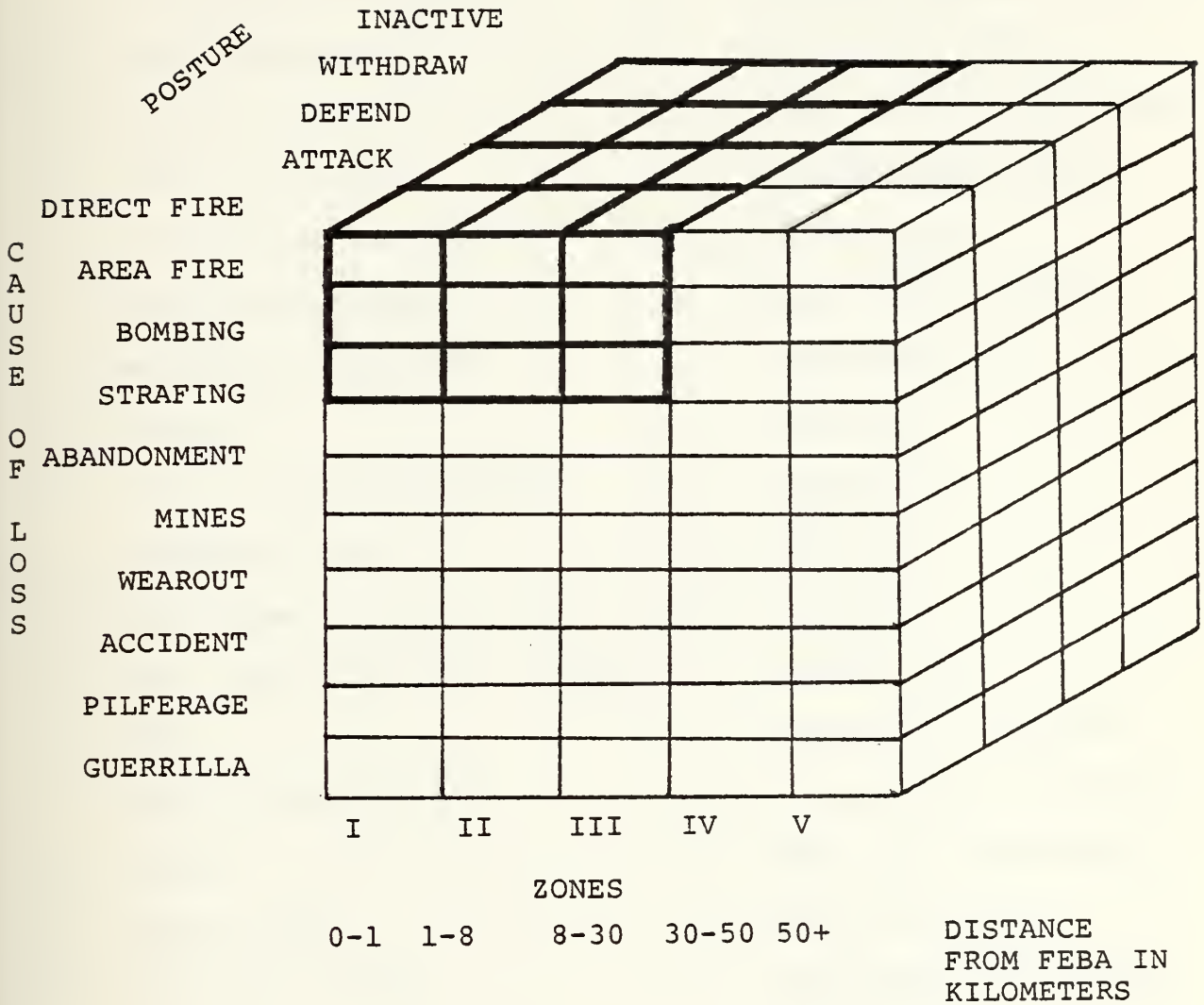
FEBA
Division Combat Area
Division Combat Support Area
Division Rear
Rear

Combat posture

Attack
Defend
Withdraw
Inactive

Figure 5-2

SYMWAR LOSS MATRIX



NOTE: Shaded area indicates cells with simulated loss rates.

Figure 5-3

SYMWAR ITEM CLASSIFICATIONS

1. Strike Airplane
2. Surveillance Airplane
3. Utility Airplane
4. Airplane Subsystem
5. Strike Helicopter
6. Surveillance Helicopter
7. Utility Helicopter
8. Helicopter Subsystem
9. Missile
10. Howitzer, Self-Propelled
11. Howitzer, Towed
12. Gun, (20mm and above), SP
13. Gun, (20mm and above), Towed
14. Tank
15. Carrier, Mortar, SP
16. Mortar
17. Machine Gun
18. Recoilless Rifle
19. Individual Weapon
20. Armored Personnel Carrier
21. Truck (less than 2.5 ton)
22. Truck (2.5 ton and above)
23. Trailer/Semi-Trailer
24. Engineering
25. Other Type Vehicles
26. Communications
27. Electronic
28. Searchlight
29. Generator
30. Fuel Tank
31. Landing Craft
32. Individual Equipment
33. Miscellaneous Equipment
34. Pumps and Compressors
35. Marine Equipment
36. Mine Detectors & Night Vision Sights

Figure 5-4

cells the two basic sources of loss data are the Concepts Evaluation Model (CEM) and the Ammo Rates Artillery Models.

The CEM is used to estimate consumption for those items of equipment which experience a significant portion of loss due to direct fire where the target can be seen and is a point of aim. Fully automated, the CEM simulation considers: [14:3-4]

(1) Weapon system and personnel losses
(2) Force mix
(3) Logistics and resupply
(4) Personnel replacement and evacuation
(5) Air and air defense
(6) Artillery
(7) Terrain
(8) Commander's decisions
(9) Massing against penetrations

For items not normally subject to direct fire, indirect (area) fire losses are computed using various artillery models from the Ammo Rates Methodology. These models utilize vulnerability classes and notional items as shown in Figure 5-5 to estimate consumption.

Historical and simulation data from the Concepts Evaluation and Artillery Models are combined with data from a shipping loss model and other sources in a bookkeeping model roll-up process. The WARF factor which results is, "The average daily non-repairable loss rate expressed as a percent of the average authorized strength in units in the combat theater." [14:3-1]

$$\text{WARF} = \frac{\text{Number of items lost per period}}{\text{Duration of period X average authorized item strength of units in the theater}}$$

WARF ARTILLERY MODEL VULNERABILITY CLASSES

Vulnerability Class	Title	Notional Item
1	Light aircraft	Helicopter, light observation
2	Light armor	Carrier, armored personnel
3	Medium/heavy armor	Combat tanks
4	Light vehicles	Truck, 1/4 ton
5	Medium/heavy self-propelled vehicles	Truck, 2 1/2 ton
6	Light boats	Bridge erection boats
7	Light towed equipment	Trailer, cargo, 1/4 ton
8	Towed artillery	Howitzer, towed, 105mm
9	Medium/heavy towed equipment	Semitrailer, 12 ton
10	Light floating equipment	Boat, landing, inflatable
11	Vehicle bridges/ ferries	Bridge section, mobile floating assault bridge
12	Ammo transporters	Carrier, cargo, 6 ton
13	POL transporters	Truck, tank, fuel servicing
14	Small arms	Rifle, 5.56mm
15	Crew-served weapons	Machinegun, 7.62mm
16	Optical and illumination instruments	Night vision sights
17	Communications/ electronic devices	Radio, portable
18	Machines	Generator set, 5-10 KW
19	Small equipment	Antenna, RC292
20	Shop sets	Shop equipment, mechanics
21	POL storage	Fuel system, 6,000 gallon
22	Water tanks	Tank, fabric, 1,500 gallon

Figure 5-5

VI. BUDGETING AND ASSET ATTAINMENT

Budgeting and procurement roles closely parallel responsibilities for determining requirements. Thus, despite recent trends towards centralized management, asset attainment requires action by HQMC, the logistics bases, retail supply outlets, and in some cases by the operating units themselves.

Fiscal constraints preclude attaining the full range of WRM. Presupposing the availability of adequate funds, realistic asset attainment goals must still consider the problems of limited shelf life, changes to contingencies and allowances, and equipment design obsolescence.

Presently, the annual planning and programming guidance issued by Headquarters considers asset deficiencies and fiscal constraints in prescribing attainment priorities for subordinate units. Unfortunately, these priorities are expressed in terms of specific contingency missions, failing to provide consistent or comprehensive guidance for making item-by-item tradeoffs.

While it is important to preserve and protect the commander's freedom to tailor a WRM package, the efficient allocation of limited resources demands some system for setting attainment priorities. This chapter will further examine and critique current procedures, and describe a simple framework for allocating resources.

A. CURRENT WAR RESERVE BUDGETING PROCEDURES

The principal document used in war reserve budgeting is the Item Readiness Study Report (P20A). This report isolates deficiencies and develops the official Marine Corps inventory objective for principal items.

The P20A is extracted from various files within the Logistics Management Information System (LMIS) at Headquarters, including the item data file, equipment allowance file, troop list file, and Procurement Marine Corps file. As shown in Figure 6-1 the first column of the report lists requirements for major active and reserve forces, mobilization training, operational projects and supply operations. Allowance and authorized inventory quantities are listed along with a subtotal in the next four columns. Post D-day consumption, estimated from CARFs, is reflected in six thirty-day increments and also subtotaled.

Initial issue and post D-day consumption are added to yield an object total for each item. As shown, this figure is offset by an estimate of the post D-day production capability and reduced to a net total. The final adjustment, listed as a "less no buy" quantity, most likely reflects a conglomeration of off-line management considerations including design obsolescence, contingency priorities, and actual or anticipated budget ceilings.

Item Readiness Study Reports and other data from the LMIS are rolled-up into the P-1 Procurement Marine Corps Budget

ITEM READINESS STUDY REPORT

PROCUREMENT OBJECTIVES QUANTITIES

TABLE OF EQUIPMENT/TABLE OF ALLOWANCE	POST D-DAY CONSUMPTION						PDD CONS TOTAL	OBJECT TOTAL	PDD PROD	NET TOTAL
	ACT RES OTHER TOTAL	D+1	D+2	D+3	D+4	D+5	D+6				
1. DIVISION FORCES										
LANT (2 MAF)										
WESTPAC (3 MAF)										
EASTPAC (1 MAF)										
RESERVE (4 MAF)										
2. SPEC MISS FORCES										
3. GEN SPT FORCES										
4. MOB TRAINING										
5. PIPELINE										
6. OPRL PROJ										
7. CONUS DEPOT										
TOTAL										
LESS NO BUY										
TOTAL QUANTITY										

NOTE: THIS IS PARTIAL FORMAT EXTRACTED FROM AN ACTUAL REPORT TO SHOW THE SCOPE AND FLOW OF INFORMATION USED IN CALCULATING OFFICIAL MARINE CORPS INVENTORY OBJECTIVES.

Figure 6-1

Report, illustrated in Figure 6-2. This report is used to present the Marine Corps budget request to the Department of the Navy and DOD. As can be seen, requirements are consolidated into line entries so that visibility of war reserve related deficiencies and decisions is lost. This condition is further exacerbated when budget requests are formulated into the appropriations structure and language required by Congress.

The system described above has several apparent weaknesses. Although the framework for decision making appears sound, the fabric is suspect. As the Marine Corps buys most of its equipment from other DOD integrated materiel managers (IMM) it is unclear where post D-day production figures are obtained. Additionally there are no IMM provisions for giving priority to any single customer, regardless of previously recorded requirements. As will be discussed in later chapters, the DOD Industrial Preparedness Planning (IPP) program is fraught with massive problems of its own.

The "less no buy" adjustment is simplistically displayed and does not summarize or shed any light on the rationale behind the adjustment decision. An appreciation and understanding of the resulting inventory objective requires such detail and specificity.

Finally, the bureaucratic bargaining process which tailors budget requests and final appropriations lacks the information to assess the impact of tradeoff decisions. Bargaining in

DEPARTMENT OF THE NAVY

FY75 PROCUREMENT PROGRAM

Appropriation: PROCUREMENT MARINE CORPS Budget Acty: 6 - ENGINEER EQUIPMENT

Line No.	Item Nomenclature	Ident Code	FY75 Unit Cost (thous)	Millions of Dollars FY73 Qty	FY73 Cost	FY74 Qty	FY74 Cost	FY75 Qty	FY75 Cost
104	ENVIRONMENTAL CONTROL EQUIPMENT ASSORTED	A	2.6	242	.7	719	1.9	313	.9
105	CRANE 25T	A	65.0			74	4.8	74	4.8
106	PHOTO SYSTEM COMBAT	A	165.1	3	.5				
107	PRINTER VIEWER IMAGERY	A	6.8	109	.7				
108	POWER EQUIPMENT, ASSORTED	A	10.2	37	.8	491	4.8	20	.4
109	BASE SUPPORT EQUIPMENT	A			4.0		2.5		2.7
110	AUTO MAT HANDLING EQUIPMENT	A			.6		.8		.7
111	NOT USED								
112	MATERIELS HANDLING EQUIPMENT	A			.5		.5		.1
113	SPECIAL TRAINING DEVICES	A			.5		.2		.2
114	MUST SYSTEM	A			4.6		6.6		6.6
115	ADP	A			2.5		4.5		4.6
116	ALLOWANCE CHANGES				.5		.6		.2
	TOTAL ACTIVITY 6				21.1		31.6		23.8
	TOTAL PROCUREMENT MARINE CORPS				182.1		219.6		228.8

NOTE: THIS IS A SAMPLE FORMAT EXTRACTED FROM AN ACTUAL REPORT TO SHOW THE SCOPE AND FLOW OF INFORMATION CONTAINED IN MARINE CORPS BUDGET REQUESTS

Figure 6-2

the blind at the appropriation level can undermine even the most logical and lucid budget request.

B. A FRAMEWORK FOR SETTING ATTAINMENT PRIORITIES

In 1956 an article in Operations Research stated: [15:431]

> The Military Services make much use of supply tables ... which have the following characteristics:
>
> 1. They consist of a bundle of spare parts which have been selected in advance to meet the supply needs of vehicles, aircraft, ships, etc., as the case may be, to the maximum extent possible.
>
> 2. The table is the sole source of supply during the period that it is in use.
>
> 3. There is one factor that limits the size of these tables, etc. In the case of a flyaway kit, this may be weight; in the case of a supply table, this may be money; and in the case of an allowance list, this may be volume. In any case, there is always some limitation to how large the table can be.

In contract work for the Marine Corps, SRI has developed algorithms for constructing tables of supply limited by budget resources, weight, volume, and the number of man-hours required to pull items from inventory and prepare them for shipment. The objective in each instance was to determine the number of units of each item which should be stocked in order to minimize shortages and stay within the operative constraint.

An obvious refinement suggested but not yet used is to weight the probability of a shortage by the combat essentiality of the particular item. A measure of essentiality is needed to cope with the major considerations when faced with a limited budget, including (1) what items must the unit have to func-

tion at a minimum acceptable level, and (2) what additional items should be funded if funding is available.

Combat essentiality is a difficult concept to measure and to treat mathematically. The effects of synergy and saturation suggest that as the total number of units of an item changes, the utility derived from each additional unit also varies. Interactions among items exist so that a shortage of one may affect the utility of a related item, i.e., jeeps and trailers. Nevertheless, practicality demands that a procedure for processing large tables of supply be mechanized and as straightforward as possible.

Figure 6-3 illustrates a process to assign priorities for attainment based on a measure of essentiality. This study previously discussed relating individual items to the mission which they support and assigning an essentiality measure based on whether that mission is primary, secondary, or tertiary to the organization. In similar manner, SRI identifies and describes 22 basic missions which a Marine Corps unit may perform, and uses the following scheme to assign weights: [16]

MISSION	DESCRIPTIVE PRIORITY	NUMERICAL WEIGHT
Primary	High priority	8
Secondary	Medium priority	4
Tertiary	Low priority	2
Other	Non-priority	1

Figure 6-4 lists the missions isolated by SRI, while Figure 6-5 illustrates classification of missions for two types of units.

ASSIGNMENT OF ATTAINMENT PRIORITIES

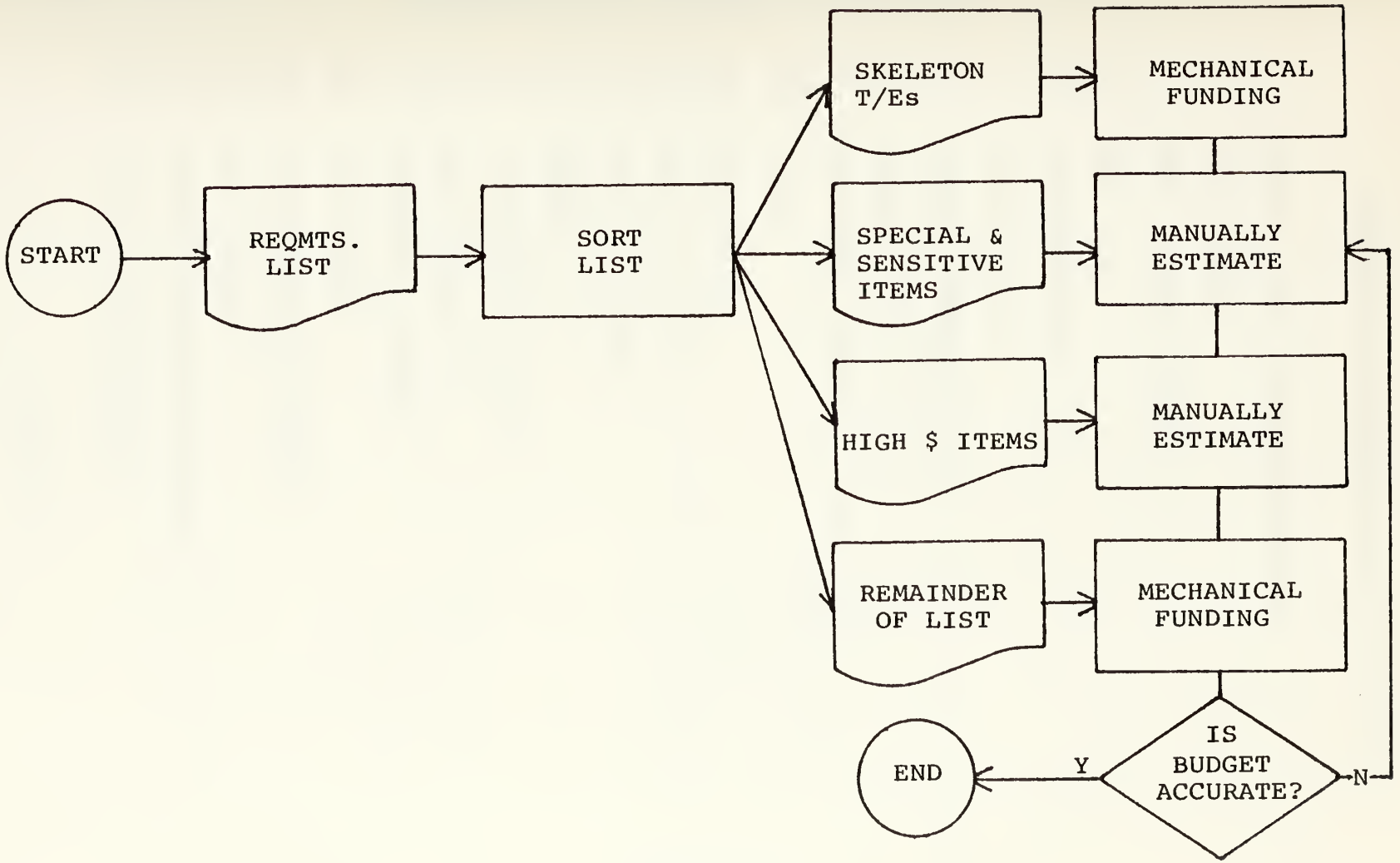


Figure 6-3

CATEGORIES OF MARINE CORPS MISSIONS

1. Infantry Small Arms Employment
2. Fire Support
3. Fire Support Control
4. Mobility
5. Communications
6. Intelligence
7. Surface Transportation
8. Engineer Construction
9. Demolition/Obstacle Clearance
10. Supply
11. Maintenance
12. Cargo Handling
13. Service Support
14. Medical
15. Air Support Control
16. Power Generation
17. Ordnance Delivery
18. Air Control
19. Air Operations Support
20. Air Transport
21. Communications/Electronics
22. Aviation Maintenance

Figure 6-4

ASSIGNMENT OF PRIORITIES TO ORGANIZATIONAL MISSIONS

PRIMARY - Principal assigned mission

SECONDARY - Directly effects primary mission

TERTIARY - Effects general performance of unit

Infantry Battalion Functions

Primary:
- Infantry Combat
- Small Arms Employment
- Mobility
- Communications

Secondary:
- Intelligence
- Demolition
- Obstacle Clearance
- Medical
- Air Support Control
- Power Generation
- Maintenance (Comm/Elect)

Tertiary:
- Supply
- Maintenance
- Service Support

Service Battalion Functions

Primary:
- Surface Transportation
- Supply
- Maintenance
- Service Support

Secondary:
- Engineer Construction
- Cargo Handling
- Power Generation

Tertiary:
- Small Arms Employment
- Mobility
- Communications
- Intelligence
- Medical

Figure 6-5

Funding prioritization begins with requirements determination. If the CARFs and LMIS data are accurate, the net total figure in the P20A report less assets already held equals deficiencies. Returning to Figure 6-3 a sort procedure groups items requiring similar management.

Skeleton Tables of Equipment (T/E) is the name applied to that class of items without which a unit cannot perform its basic missions. Deficiencies in items identified in this class receive top priority in allocation and can be automatically funded if the budget permits. Funding shortages encountered at this point indicate a strong need to reprogram funds from other areas or seek a supplemental appropriation.

The next two classes of items are special and/or sensitive materiel and high-dollar equipment. While no definitions or thresholds are suggested for these classes, it is obvious that such things as nuclear, chemical and biological weapons and equipment, or multi-million dollar aircraft are not compatible with machine management or a simple logic routine. Manual estimation of attainment quantities in these classes permits consideration of a wide range of special management factors.

Finally, the remainder of the deficiencies can be ranked by weighted essentiality/utility and funded until the appropriation is exhausted. If the resulting block appears unsatisfactory in any manner, a revised table can be constructed by re-entering the process after filling of the skeleton T/Es.

Though simplistic, such a plan would be a worthy first step towards consistency and control, while improving communications and both individual and collective understanding of the attainment process. Experience and close observation of the early iterations would provide a better base for refinement of the process than a prolonged search for a more sophisticated initial procedure.

VII. PROBLEMS AND ALTERNATIVES

This chapter will re-examine some previously identified problems in war reserve planning and management as well as introduce several new considerations. For presentation purposes only, topics have been grouped as (1) technical problems, (2) problems associated with better use of war reserve assets, (3) the use of commercially available products, (4) industrial preparedness planning, and (5) implications of current discussions regarding the future of the Marine Corps.

A. TECHNICAL PROBLEMS

The foremost problem in this, if not all, areas of war reserve management is item essentiality. This concept is simultaneously elusive to measure and pervasive in its effect on requirements determination and asset attainment. This study has suggested a method for establishing comparative essentiality among items based on the precedence of the various missions assigned to a unit. Annual guidance developed by HQMC provides inter-contingency priorities which, although a vital part of essentiality, are difficult to implement and of little value in assessing item-by-item tradeoffs.

LMI, in exploring the complete question of essentiality, isolated three components: [10:40]

(1) item essentiality - which items are most critical to the success of a given mission,

(2) mission essentiality - which missions are most critical to the success of overall unit operations,

(3) component force essentiality - which units/missions are most critical to the success of overall force operations.

Quantification of the several components of essentiality complicates processing and further increases the dependence of the procedure on subjective judgement.

LMI further suggests that requirements be related to specific contingencies, i.e., reinforcement and defense of the Danish islands against Soviet invasion instead of the generally expressed ability to repel an enemy by fire and close combat. As the Marine Corps does not currently have such missions assigned, and as specific contingencies dictate specific requirements, this change would add yet another dimension to essentiality. Under constrained budget conditions any system for prioritizing asset attainment would have to be capable of dealing with the relative criticalities and probabilities of competing world-wide contingencies.

Chapter III pointed out that item selection procedures for war reserves are heavily judgmental, fragmented among different organizations, and not fully coordinated with other logistic and tactical considerations. An additional aspect which is often neglected is the interchangeability and substitutability characteristics of individual items. In order

to prevent the exaggeration of requirements, LMI suggests that stockage objectives be computed for groups of related items. Families so identified would be treated in the attainment process such that those members designated most preferred or widely adaptable would be funded first. The greatest incidence and impact of such relationships is in repair parts.

Chapter V identified excessive reliance on judgment and the increasing inapplicability of incomplete and aging historical data as problems in determining replacement factors. Mandating a uniform calculation procedure, moving towards sophisticated simulation, and capturing accurate data from peacetime operations are all elements of a solution.

The final technical problem to be discussed deals with the classification of war reserve materiel. Presently, with the exception of a small amount of supplies managed by the Navy, virtually all Marine Corps WRM is classed as pre-positioned. This decision is based not only on the normal considerations which dictate pre-positioning, but also on the lack of a priority issue/attainment system at the integrated manager level which would permit the Marine Corps to rely more heavily on IMMs.

GAO comments illustrate increasing disfavor with the apparent diseconomies in this situation: [17:28]

> ... If the appropriate DOD integrated managers stored war reserve materiel at their depots, space now used for this purpose at Albany and Barstow would not be needed. The Corps already obtains 39,940 of its 48,592 war reserve items (82 percent) from other integrated managers; and these include 39,810 consumable items such as nuts, bolts, and spark plugs, which would require little storage space at other depots. ... We understand the Marine Corps preference for storing its war reserve and other materiel at Corps depots instead of other DOD depots. However, this is a costly preference.

The Marine Corps response to this criticism states:

[18:6]

> The current method used by the Marine Corps for managing and distributing Prepositioned War Reserve Stocks is considered essential to provide rapid response to changing situations/missions. Although other integrated managers could hold Marine Corps PWRS, under current policies and procedures, they cannot guarantee to provide all quantities, funded by the Corps, when withdrawal is necessary. The recent Near-Term Prepositioned Ships Program (NTPS) was accomplished by the Marine Corps mainly due to its ability to control and direct the use of their PWR assets ... If assets were held by various other integrated managers, the coordination/control efforts alone would have caused serious delays ... The availability of warehouse space is not the main concern when positioning supplies, especially PWRS. Rather the prime concern is the capability for the expeditious withdrawal of the supplies to satisfy demands in a responsive manner. The Marine Corps has prepositioned assets at Albany and Barstow sites, both of which have close access to seaports via an extensive rail and highway net, for rapid response to operating force requirements in the Atlantic and Pacific. By consolidating its PWRS at these two depots, withdrawal efforts can be readily directed ... without competing with services or priorities and without disrupting their DOD activities.

Not mentioned are bitter memories of past experiences with IMMs such as the Vietnam-era episode of Marines fighting with M-14s while Air Force units drew upon limited stocks of the

more advanced M-16 service rifle. While current Corps procedures may circumvent prescribed policy, they do so for very good reason. The problem is not the Marine Corps action but the situation which makes it necessary and the possibility that GAO or others may force adherence to the letter of current regulations without correcting inequities in IMM attainment and issue.

B. BETTER USE OF WAR RESERVE ASSETS

The original impetus for this study came from war reserve managers in Albany, Georgia interested in ways to better utilize war reserve inventories. The very nature of WRM -- assets to be protected for use in emergency situations -- places considerable restrictions on just what can be done. But in the development of this study several ideas have been suggested. Many of these spring from the war reserve mission of providing support for a limited period of time, namely the D-day to P-day concept, while others are related to special characteristics of war reserve inventories.

The first suggestion is that in-use assets be carefully monitored and rotated into a war reserve status when operational and maintenance considerations clearly favor exchange for an identical item held in war reserves. The logic here is that war reserve items need be serviceable and ready-for-issue, but not new. This argument takes on even greater significance in the later years of an equipment life cycle.

At that time maintenance and spare parts support are often difficult, while procurement of new items of aging design is unsound.

A similar proposal for improving support during the later years of an equipment life cycle is to release war reserve assets to active forces as they can be replaced by items of the follow-on design. Presently the new items are procured and held, often for extended periods, until complete allowance quantities, spare parts and supporting publications are on-hand. As delays more often than not accompany this complicated attainment process, FMF users of the equipment to be replaced find themselves with overaged items, shortages of repair parts, and possibly a lack of operators and maintenance personnel as staffing changes occur in accordance with the original schedule for fielding the new equipment. Careful and coordinated management and release of war reserve assets might ameliorate some of these problems.

The above suggestions can be advanced because of the geographical proximity of war reserve stocks and the units involved. Similarly, coordination of the war reserve effort with other programs at logistic and operational bases can reduce overall equipment investment and provide for exercising and maintaining war reserve assets. Examples of such possibilities include:

(1) Using war reserve assets at the logistics bases to smooth-out production runs and avoid bottlenecks in the depot rebuild program,

(2) Using war reserve assets for training purposes at formal schools,

(3) Using war reserve assets for support of Marine Corps Reserve units,

(4) Using war reserve assets for central equipment pools such as that maintained by the Marine Corps Air-Ground Combat Center (MCAGCC), Twentynine Palms, California,

(5) Using war reserve assets to support the direct exchange programs of Operational Readiness Float and Maintenance Float accounts.

These suggestions are made because of the close relationship between the readiness of active forces and the need for war reserves. WRM and PFMR are complimentary parts of the War Materiel Requirement. Management ingenuity and initiative can be exercised in the considerable gap which exists between asset postures of satisfactory and sacrosanct.

C. COMMERCIAL PRODUCTS

The federal government has stressed reliance on commercial goods and services for many years. Such initiatives as Office of Management and Budget (OMB) circular A-76 dealing with the acquisition of commercial and industrial products and services, and the Commercial Commodity Acquisition Program

(CCAP) have forced government organizations to justify departures from commercial reliance.

Commercial reliance as a procurement policy stresses the potential for reductions in cost and lead time, increases in the availability of items and parts, improved maintenance and logistics support, and a strengthening of the defense industrial base. Overshadowing all political and economic considerations, however, is the inherent truth that there are some very real differences between military and commercial requirements. Unique mission and environmental considerations must be identified and dealt with. Readiness is not just a goal, but a matter of survival.

Often these differences are not interpreted as considerations, but as constraints. A system which believes that any jeep, radio, forklift, or electronic test set must be able to be used in a combat environment anywhere in the world procures suitable assets. Thus, as an example, every jeep has fording and winterization capabilities which will probably never be used, and which eliminate from consideration for procurement commercial products which are less expensive to purchase, operate and support, and which would prove entirely satisfactory in most operating situations.

Related to this ultimate use paranoia is the common practice of gold-plating requirements. This results in a product specification which represents a summation of technological capability rather than the answer to a specific

need. This practice makes the identification of a suitable commercial product virtually impossible and leads to exorbitant development and procurement costs, as well as unnecessarily complicated training and support.

Within DOD the forces of inertia and notions of poor quality equipment which cannot be supported in a military environment work against buy-commercial initiatives. Much of this sentiment comes from Vietnam-era horror stories of commercial substitutes which could not measure up. Such feelings ignore the critical if not completely successful role which commercial products played in plugging the gaps created by long lead times for military products. Also discounted is the fact that an effective buy-commercial program would narrow the gap between defense and non-defense production, and hopefully improve the availability of suitable materiel during mobilization surge demand periods.

A full discussion of the merits and demerits of commercial products is beyond the scope of this study. The point to be made is that some of the major criticisms of commercial products are less forceful when applied to war reserves intended for use for a limited time. Equipment and support options considered unacceptable for prolonged periods may be satisfactory during the war reserve period if significantly lower investment and holding costs hang in the balance.

D. INDUSTRIAL PREPAREDNESS PLANNING

Stockage of war reserves and the use of products which are readily available in the commercial market are two ways of dealing with the D-day to P-day gap. A third approach is to reduce the gap itself through industrial preparedness planning. Although such planning would primarily be accomplished by integrated managers, it remains a valid offset to war reserve requirements as recognized by the WMPC.

In a GAO report in 1977 the Secretary of Defense was quoted as follows: [19:1]

> A viable industrial base is a major element of our national strength and deterrent posture, and maintaining the capacity of that industrial base to respond to potential warfare demands continues to be a major consideration in our defense planning. In some specific areas, however, we have experienced a gradual erosion of the defense industrial base. Material scarcities, increases in production lead times, and the cost burden to comply with safety, health, and environment protection requirements are symptoms of this erosion. In addition, private industry is less willing to accept the complexities of doing business with the Defense Department as the proportion of defense spending in the economy decreases.

This erosion is manifested in the changing number of defense contractors and subcontractors, and in known, yet persistent, shortages of critical commodities. [19:1]

> DOD officials have expressed concern over the diminishing number of subcontractors and the growing dependence on foreign sources for military parts and components. Through recent attempts to quantify the problem of a diminishing contractor base, DOD has identified several military items for which there is inadequate production capacity, including aircraft engines, radar, landing gears, and navigation systems. Shortages were also observed in tank hull castings, gun mounts, and infrared systems.

If these conditions exist during peacetime, the risk and implications under an accelerated demand scenario are indeed grim.

In its report to Congress, GAO characterized contractor IPP input as insufficient, unreliable, and generally lacking in detailed planning and analysis. [19:3] Input was plagued with unrealistic assumptions, insufficient supporting data, and a lack of planning for the lower tiers of the defense industrial structure. Some contractors refuse to conduct planning at all, dismissing it as an empty exercise without a full consideration of vendors and subcontractors. More commonly, however, contractors superficially blunder through the process, erasing potential problems with grandiose assumptions and failing to arrive at comprehensive and feasible solutions for those problems which are identified.

A major reason for the lack of contractor effort is the voluntary nature of the program. Proper planning would require diverse and specialized talents, voluminous detailed information, and a great deal of human and computer time. The sum total of these factors is a weighty price tag, yet DOD does not fund contractor efforts.

A second contributing factor to contractor indifference is the program's lack of credibility. The token quantities of resources committed to the effort by DOD certainly inspire something other than confidence and respect in industrial participants. Additionally, the lack of feedback and follow-

on effort leads contractors to conclude that it is no more than an empty exercise. The futility and frustration experienced by DOD planners themselves is illustrated by a statement from an Air Force Logistics Center Office: [19:11]

> ... more than five IPP cycles have been completed and several thousand items have been selected and sent to industry and repair facilities for planning. To date, no funds have been provided to purchase Industrial Preparedness Measures ... for one single item ... Throughout the period of involvement in Southeast Asia, these measures were not implemented and it was possible to satisfy Air Force requirements through a judicious process of priorities and allocations. Based on past experience of this program, recommend this program be eliminated.

The state of IPP has been reviewed to show that an area of potential savings is currently an area of considerable uncertainty. Poor planning which identifies erroneous problems or gives false illusions of adequacy is worse than no planning at all.

In a final note, streamlined procurement procedures aimed at reducing the administrative lead time involved in defense procurement could also influence the war reserve support period.

E. FUTURE CONSIDERATIONS

The final category of potential problems deals with the future. The advent of the 1980s found Congress, the Marine Corps itself, and other organizations examining future roles for the Corps. Questions related to mission orientation, and force size and distribution highlight the possibility of

significant changes in the nature and size of equipment allowances. Such changes could have an obvious impact on war reserve requirements and policies.

The impetus for this concern lies in recent international developments, changing perceptions of the NATO/Warsaw Pact balance, and the recurring theme that amphibious assaults against defended beachheads are a military anachronism. The question of the viability of an amphibious assault capability challenges several unique characteristics of the Corps:

(1) Marine Corps Divisions are light, foot infantry, short in armored ground mobility and firepower in comparison to similar U.S. Army and foreign infantry units.

(2) Air Wings with massive firepower are operationally integrated with the Divisions, which also enjoy greater helicopter-borne mobility than their military counterparts.

(3) Slow moving ships and landing craft used in amphibious assaults appear to be especially susceptible to recent advances in weaponry such as precision guided munitions.

In combination with changing roles, missions, and areas of operation, the continuing lack of strategic mobility -- especially sealift -- further focuses attention on prepositioning options. In a recent report to Congress, the Congressional Budget Office identified four alternative postures

for the Marine Corps of the future. These options and their implications are summarized in Figure 7-1.

The purpose of this section in this study is not to suggest alternatives, but to point out that discussions with far-reaching consequences for war reserves are taking place. Internally designed and controlled reform and transition are undoubtedly preferable to the less well-informed dictates of external offices and agencies.

War reserve-related problems cover a multitude of areas indeed. Solutions to these problems require imagination, coordination, and above all, concentrated attention. General and specific recommendations will be offered in Chapter VIII.

COMPARISON OF MARINE CORPS BUDGET OPTIONS

OPTION	MISSION ORIENTATION	FORCE DISTRIBUTION
I.	Maintain current general purpose/ amphibious role	3 Divisions 1 afloat brigade (battalions in Mediterranean Sea, Pacific and Indian Oceans) 3 brigades for RDF 5 brigades for SACEUR reserve) 1 plus MAF sealift 3 Air Wings
II.	Prestocking for a Europe-oriented Marine Corps; limited amphibious role against opposition	3 Divisions 2/3 afloat brigade (battalions in Mediterranean Sea and Indian Ocean) 4 brigades for Denmark 1 brigade for Norway 1/3 brigade for Iceland 1 brigade for Asia/RDF 2 brigades for SACEUR reserve 2/3 MAF sealift 3 Air Wings
III.	Prestocking in Indian Ocean; amphibious lift for quick-strike Marine force	3 Divisions 1-2/3 afloat brigades (3 MAUs in Indian Ocean; 1 MAU in Mediterranean Sea; battalion in Pacific Ocean 3 brigades for RDF 4-1/3 brigades for general purpose 1-2/3 MAF sealift 3 Air Wings (less 3 fighter/ attack squadrons)
IV.	Prestocking for flexible Marine operations in northern Europe and the Indian Ocean	3 Divisions 1 afloat brigade (as in #I) 3 brigades for RDF 2 brigades for northern Europe 3 brigades for general purpose 1 plus MAF sealift 3 Air Wings (less 3 fighter/ attack squadrons)

Source: [2:48-49]

Figure 7-1

COMPARISON OF MARINE CORPS BUDGET OPTIONS

OPTION	NATURE OF FORCES	KEY BUDGET DECISIONS
I.	Light infantry with sufficient equipment to support three armored brigades; primary fire support from aircraft; amphibious ships for major opposed landings	Procure: Equipment for RDF LSD-41 MPS (1) RORO (2) F/A-18 Develop: LCAC CX Milcon: Diego Garcia, Kenya, Oman, and Somalia Cancel: AV-8B
II.	Heavy brigades in Jutland; light forces elsewhere; prestocking for forces in Norway, Denmark; aircraft primary fire support for two divisions	Procure: F/A-18 Equipment for RDF MPS (1) RORO (2) Develop: CX Milcon: Diego Garcia, Norway and Denmark Cancel: LSD-41; LCAC; LVTP-7; AV-8B
III.	Light armored infantry with major amphibious orientation; prestocking for forces in the Indian Ocean; reduced airborne fighter/attack support	Procure: MPS (1) RORO (2) Equipment for RDF Light armored vehicles Develop: LCAC Light armored vehicles AV-8B C-5 variant Milcon: Diego Garcia Cancel: CX; USMC A-18
IV.	Light armored infantry; mixed amphibious and land orientation; reduced airborne fighter/attack support	Procure: MPS (1) RORO (2) Equipment for RDF 2 brigades on MPS in Great Britain Develop: CX; LCAC; AV-8B Light armored vehicles Milcon: Diego Garcia and Great Britain Cancel: USMC A-18

Figure 7-1 (cont.)

VIII. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A. SUMMARY

The contents of this study can best be summarized by returning to the major questions which defined the thesis intent.

To maximize the benefits derived from war reserve dollars, a system of establishing comparative essentiality between items, missions, forces, and contingencies is needed. Such a system, based on the missions normally assigned to a given type of unit, has been suggested. Central to implementing this scheme and establishing spending priorities is the recognition that some items involve management considerations which defy computerized decision-making. The concept of a skeleton T/E has been introduced as a basic block of material without which a unit cannot perform those minimum essential mission-related tasks. This block, if accurately identified, is useful in identifying problems and deficiencies, and coping with budget, lift, storage and other constraints.

Increasing the utilization of war reserve materiel first requires abandoning the philosophy that protection of these assets means forbidding their use. Suggestions herein include rotating used but serviceable items into war reserves, accomplishing attainment of newly procured items in war reserves while simultaneously releasing predecessor items to

the field, and supporting a variety of programs and organizations with war reserve assets. The ultimate goal of these actions is to change war reserves from a materiel militia awaiting the call to arms into a truly active inventory.

Alternatives to war reserve stockage such as industrial preparedness planning and the use of acceptable commercial products remain largely unexplored, but certainly have some potential to reduce total war reserve requirements.

The types of solutions needed go beyond more efficient management to new and different ways of doing business, and rethinking the self-imposed concepts and constraints of the past.

B. CONCLUSIONS AND RECOMMENDATIONS

As a result of constraints surrounding the research effort and the thesis intent itself, the conclusions and recommendations are general in nature. Suspicions and suggestions are offered in place of confirmed facts or final solutions in some cases.

Based on the research described in this study, the following conclusions were reached:

(1) War reserve policy suffers from inconsistent application and a misunderstanding of the complete process, especially in the areas of item selection, requirements determination, and budgeting.

(2) While responsibility may, of necessity, be divided between offices and organizations, coordination and an understanding of necessary interactions cannot be sacrificed.

(3) Current procedures rely too heavily on judgment and special experience which are subjective and breed inconsistency.

(4) Proposed changes and systems are easily evaluated in light of obvious shortcomings while the potential for improvement is overlooked.

(5) War reserve needs are dynamic and must be frequently and methodically reviewed.

(6) Logistics factors such as lift capacity and maintenance capability are frequently ignored when stockage decisions are made.

(7) Possible alternatives to war reserve stockage are not being effectively explored.

(8) The full potential for use of physical assets in the war reserve inventory is not being realized.

Relative to these conclusions, recommendations include:

(1) That the war reserve process be automated to a much greater degree. Considerable attention must be devoted to program logic and the identification of classes of items requiring special consideration and manual intervention.

(2) That the war reserve system must be periodically exercised, questioned, reviewed and adjusted in light of performance and changing requirements.

(3) That a system to better measure comparative essentiality be designed and implemented.

(4) That war reserve information systems be modified to reflect multiple criticalities for different uses of an item, or an aggregate figure which is more representative than the most critical use.

(5) That the concept of skeleton T/Es be explored as a vital building block and tool for coping in real time with a wide variety of constraints, and for identifying shortages and problems requiring immediate attention.

(6) That those items/classes of materiel which are most likely to have suitable commercial substitutes be identified. Following certification of their suitability, options such as increased contractor support or contractor stockage of contingency inventories could be considered.

(7) That Defense Property Disposal Office excess lists be screened for items which could fill a gap in war reserves.

(8) That ideas for additional uses of war reserve assets be solicited from within the Marine Corps.

(9) That priorities for asset attainment be linked to withdrawal procedures to ensure that materiel is distributed to fill the highest priority need.

(10) That the ideas and suggestions addressed in this study be further investigated.

Automation, forecasting requirements, quantifying essentiality and similar improvements involve significant technical and theoretical problems. Progress should not be held back by looking for the ultimate answer. Incremental improvements which are simple, soundly conceived, well understood and consistently applied will point in the right direction.

Finally, optimum war reserve performance and utilization, much like supply economy, is more a philosophy than a procedure. It cannot be a singular responsibility. While war reserve managers may function as policemen, Marines, both uniformed and civilian, must be concerned practitioners.

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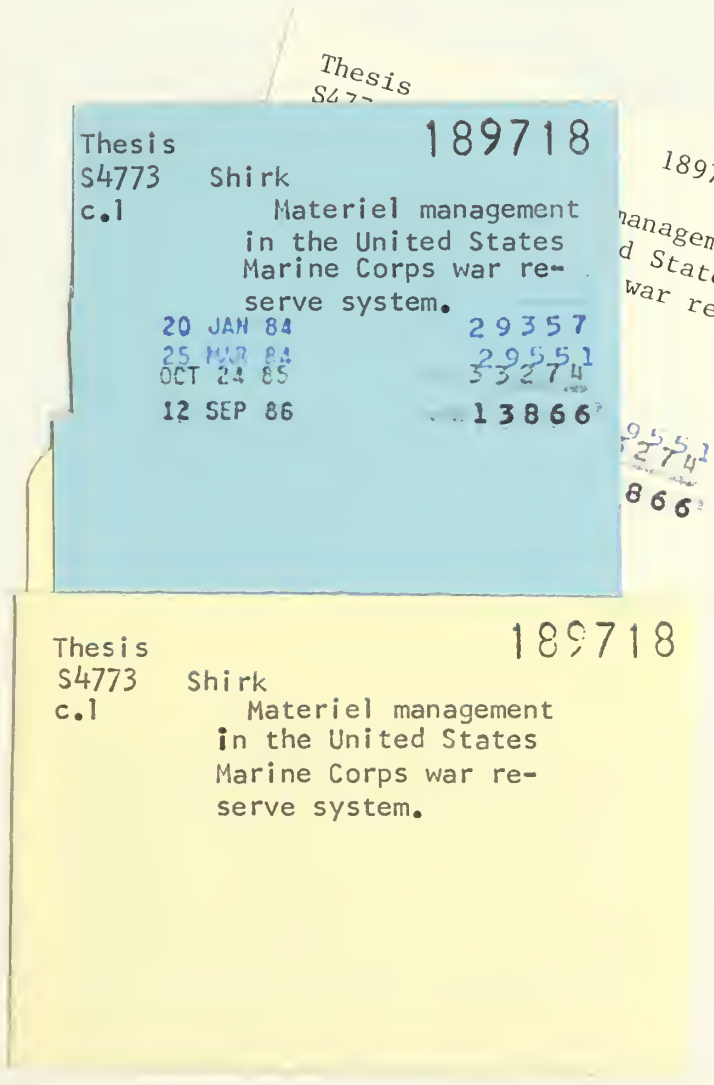
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